APPENDIX A: Data Analysis

Table of Contents

Chapter 1 Overview of Research Design

- The survey design relies on stratified simple random sampling, with probability weight adjustment for non-response bias for Type I and some of the Type II Habitat permits reviewed
- Permits were stratified as follows: Type I Habitat, Types II and III Habitat, and Wetlands

Table 1-1. Population and sample sizes by strata

Strata #	Cases Types	Total N (population)	Total n (sample)
1	Type I Habitat	439	135
2	Type II and III Habitat	97	62
3	Wetland	422	146

The survey design assumes equal probability of selection for each site for Strata #3; Wetlands did not require permission to be visited, thus they had equal probability of selection in the sample (they were randomly selected).

For Strata #1 and some of the Type II Habitats belonging to Strata #2, probability weights were adjusted to account for non-response bias. Type I and part of the Type II Habitats required owner permission and we strongly suspected that cases that agreed to be visited were more likely to be successful that those that denied access or did not respond. Thus, the survey design was modified to account for non-response bias by adjusting the probability weights for Strata #1 cases and those Type II cases in Strata #2 that required owner permission.

Strata #1 = 439 Type I Habitat permits:
- 55 granted permission → 55 were visited
- 31 denied permission → 3 were visited (observed without entering property)
- 353 did not respond → 77 were visited (observed without entering property)

Strata #2 = 97 Type II & III Habitat permits
- 30 Type III Habitats did not need permission → 25 were visited
- 44 Type II Habitats did not require permission → 27 were visited
- 23 Type II Habitats required permission
  a. One granted permission → One was visited
  b. Two denied permission → One was visited (observed without entering property)
  c. 20 did not respond → 8 were visited (observed without entering property)

Strata #3 = 422 Wetland permits → 146 were studied

All estimates and confidence intervals are based on the survey design described above. Significance tests and p-values are based on $\chi 2$ tests of association with Rao-Scott corrections.

IMPORTANT NOTES

- "Actual/sample data" and "data distributions" present information about the cases in the *sample*.
- "Estimates" and "estimated distributions" are *population estimates* based on the sample data and the survey research design.
- When the n is very small (the actual sampled cases), it is not feasible to produce population estimates.

Chapter 2 Success of Habitat and Wetland Mitigation

Question:

1. Can the mitigation strategy be considered successful?

Results:

Table 2-1. Success rates by permit type

Strata*	Estimate	95% confidence interval
All cases (n=343)	39.56%	35.07% - 44.06%
Type I Habitat (n=135)	26.35%	19.33% - 33.38%
Types II & III Habitat (n=62)	39.06%	31.40% - 46.71%
Wetland (n=146)	53.42%	46.80% - 60.05%

*Differences in success rates between strata are statistically significant (p=.001).

Table 2-2. Success rates for Type I Habitat Permits by applicant response

Applicant Response*	Success Rate	95% Confidence Interval
Agreed to site visit (n=55)	43.64%	32.59% - 54.68%
Denied site visit or did not respond (n=80)	23.88%	16.06% - 31.69%

*Differences in success rates between respondents and non-respondents are statistically significant (p<.01).

All Wetland permits and Type III Habitat permits require a conservation covenant that grants county staff access to mitigation cases for compliance monitoring. An analysis of Type II Habitat permits that required permission is not feasible due the small sample size (of the 23 Type II Habitat permits in the study, only one agreed to the site visit).

Conclusions:

- Mitigation for Wetland and Habitat permits is successful about 40% of the time.
- Mitigation for Wetland permits is more likely to succeed.
- Mitigation for Type I Habitat permits is less likely to succeed.
- Type I Habitat permit applicants willing to grant access to County staff are more likely to succeed than those who do not.

Chapter 3 Mitigation Elements

The study examined 13 common elements of Habitat and Wetland mitigation plans. The data reported for these elements show the following:

- How frequently the element is required and completed.
- A comparison of success rates when the element is required and completed versus not completed.
- The distribution of functional ratings[1] when the element was required.

IMPORTANT NOTES

- These elements are either proposed by the applicant or required as conditions of approval by staff.
- Elements are considered "required" in either case for the purpose of this study because once a plan is approved, the proposed elements become conditions of the permit.

[1] Refer to the Monitoring Evaluation Manual (Appendix Y)

Chapter 3.A Buffer Averaging

Questions:

1. Was Buffer Averaging required?
2. Has it been completed when it was required?
3. Does Buffer Averaging affect success of the mitigation?
4. How well does Buffer Averaging function when it is completed?

Results:

Table 3.A-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	1	7	43	51
Not required	134	55	103	292
Total	135	62	146	343

Table 3.A-2. Population estimate for the proportion of sites where Buffering Averaging was required

Strata	Percent required	95% confidence interval
All sites (n=343)	14.12%	11.36% - 16.88%
Habitat Type I (n=135)	0.23%	0% < - 0.61%
Habitat Types II & III (n=62)	10.27%	5.78% - 14.76%
Wetlands (n=146)	29.45%	23.40% - 35.50%

Table 3.A-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	-	7	42	49
Not completed	1	-	1	2
Total	1	7	43	51

Table 3.A-4. Estimate for the proportion of cases where this element was required and completed

Strata*	Percent completed	95% confidence interval
All cases (n=51)	97.12%	*Missing standard errors because of stratum with single sampling unit (strata 1 has one observation only)*
Wetlands (n=43)	97.67%	93.23% - >100%

*Since the large majority of the cases are Wetlands (43 out of 51), no population estimates were produced for Habitats.

Table 3.A-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=51)	35.17% (24.13% - 46.22%)	0%(N/A)
Habitat (n=8)	28.57% (7.89% - 49.25%)	0%(N/A)
Wetland (n=43)	35.71% (23.86% - 47.57%)	0%(N/A)

Table 3.A-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	1	1
2	-	-	3	3
3	-	1	10	11
4	-	6	4	10
5	-	-	20	20
Total	-	7	38	45

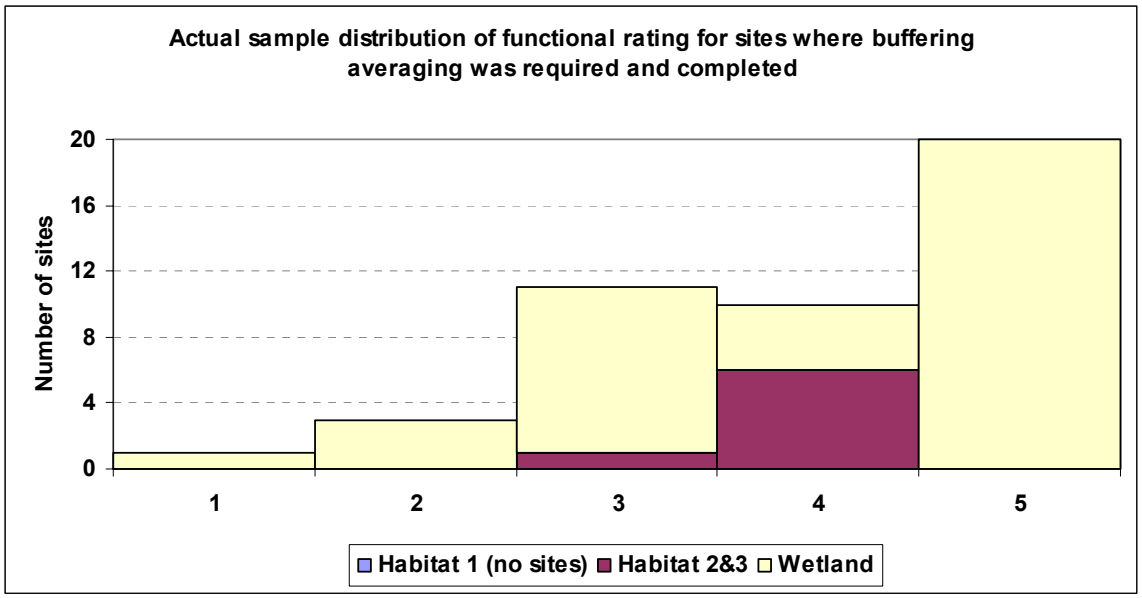

Figure 3.A-1. Actual distribution of functional ratings for this element

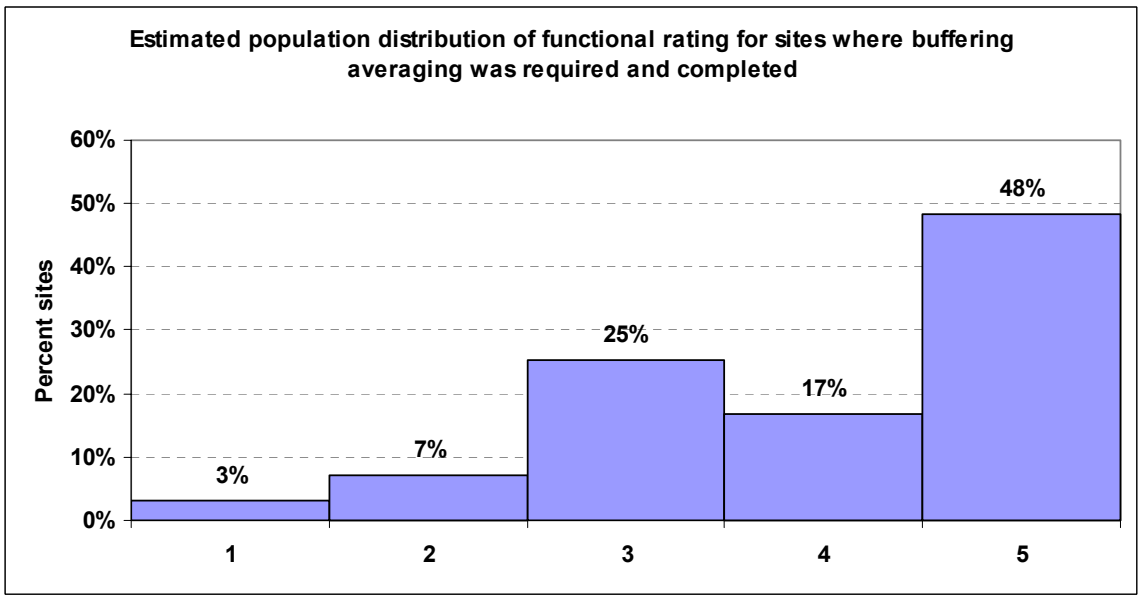

Figure 3.A-2. Estimated distribution of functional ratings for this element

Conclusions:

- Buffer Averaging is more common for Wetland permits.
- When used, it is almost always completed and generally performs well.
- Buffer Averaging and the success of Buffer Averaging has no impact on the success of the rest of the mitigation plan.

Chapter 3.A.2 Related Analyses

Chapter 3.A.2-1 Effect of Access Management (Chapter 3.C) and Physical Demarcation (Chapter 3.D) Elements on Buffer Averaging

Questions:

1. If Physical Demarcation or Access Management were required in addition to Buffer Averaging is there a significant affect on the performance of Buffer Averaging?
2. If Physical Demarcation or Access Management were required in addition to Buffer Averaging is there a significant affect on mitigation success?

Results:

Table 3.A-7. Actual distribution of Buffer Averaging functional rating if Access Management AND Physical Demarcation were required and completed (n=5)

Rating	Habitat I	Habitat II & III	Wetland	Total
1	-	-	-	-
2	-	-	-	-
3	-	1	1	2
4	-	-	-	-
5	-	-	3	3
Total	-	1	4	5

Table 3.A-8. Actual distribution of Buffer Averaging functional rating if EITHER Access Management OR Physical Demarcation were required and completed

Rating	Habitat I	Habitat II & III	Wetland	Total
1	-	-	-	-
2	-	-	1	1
3	-	1	6	7
4	-	4	2	6
5	-	-	17	17
Total	-	5	26	31

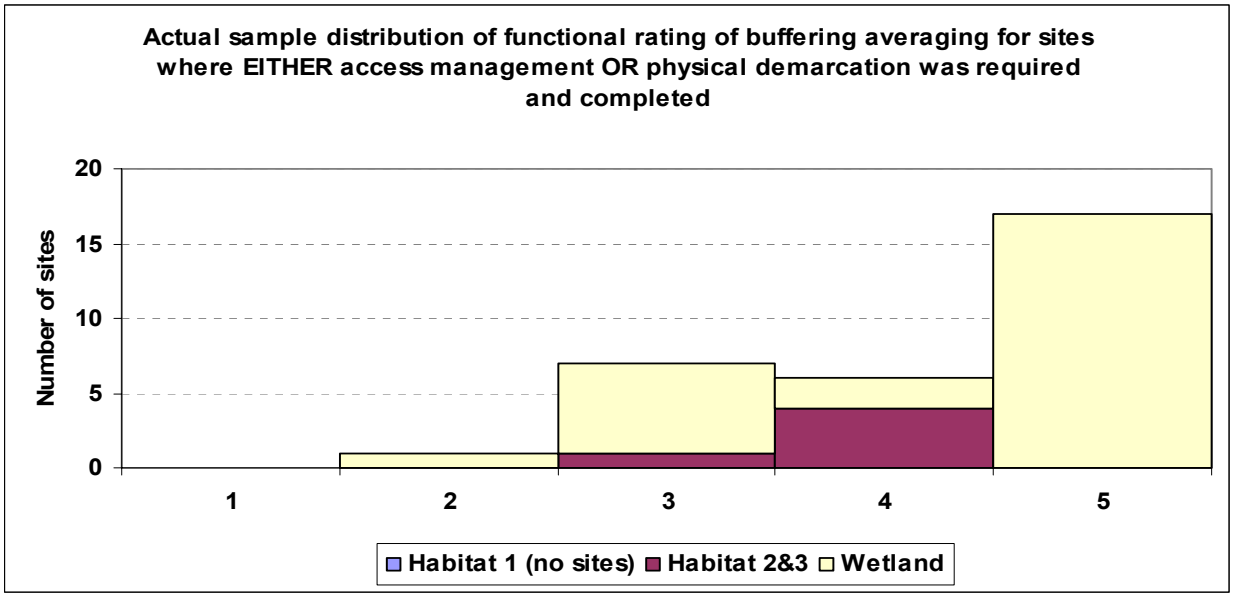

Figure 3.A-3. Actual distribution of functional ratings for Buffer Averaging if EITHER Access Management OR Physical Demarcation were required and completed

Table 3.A-9 Success rates as a function of ratings of Buffering Averaging and Access Management for sites where both were required and completed.

For this analysis, n=5 (there are only five sites that were required and completed both elements). All five sites had ratings of 3-5 on both elements, however only one of the five sites was a success. (Insufficient n for graphics and analyses)

Conclusions:

- Access Management and Physical Demarcation help ensure the success of buffer averaging.
- There is not enough data to determine if this combination affects mitigation success.

Chapter 3.B Signage

Questions:

1. Was Signage required?
2. Has it been completed when it was required?
3. Does Signage affect success of the mitigation?
4. How well does Signage function when it is completed?

Results:

Table 3.B-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	6	34	146	186
Not required	129	28	0	157
Total	135	62	146	343

Table 3.B-2. Population estimate for the proportion of sites where Signage was required

Strata	Percent required	95% confidence interval
All Sites (n=343)	50.10%	47.74% - 52.49%
Habitat Type I (n=135)	2.18%	0.27% - 4.10%
Habitat Types II & III (n=62)	49.88%	41.98% - 57.78%
Wetlands (n=146)	100%	100 % - 100%

Table 3.B-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	5	28	45	78
Not completed	1	6	69	76
Total	6	34	114	154

Table 3.B-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases (n=154)	46.07%	39.23% - 52.90%
Habitat* (n=40)	83.55%	73.51% - 93.58%
Wetland (n=114)	39.47%	31.69% - 47.26%

*The n is too small for an analysis by strata; however we can group the Habitat strata. Wetlands are less likely to complete the signage when required (p<.001).

Table 3.B-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=154)	57.54% (48.44% - 66.63%)	41.47% (32.36% - 50.58%)
Habitat*(n=40)	50.92% (38.48% - 63.36%)	29.84% (8.58% - 51.09%)
Wetland (n=114)	60.00% (48.29% - 71.71%)	42.03% (32.50% - 51.56%)

*The n is too small for an analysis by strata; however we can group the Habitat strata.

Table 3.B-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	3	3
2	-	2	9	11
3	1	6	14	21
4	1	12	8	21
5	1	8	9	18
Total	3	28	43	74

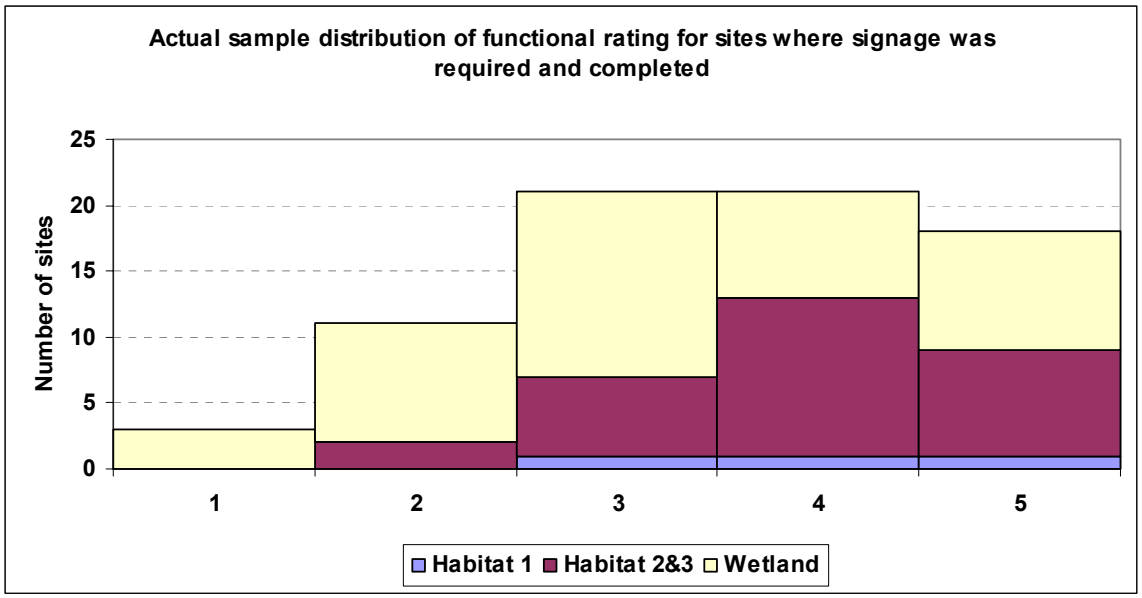

Figure 3.B-1. Actual distribution of functional ratings for this element

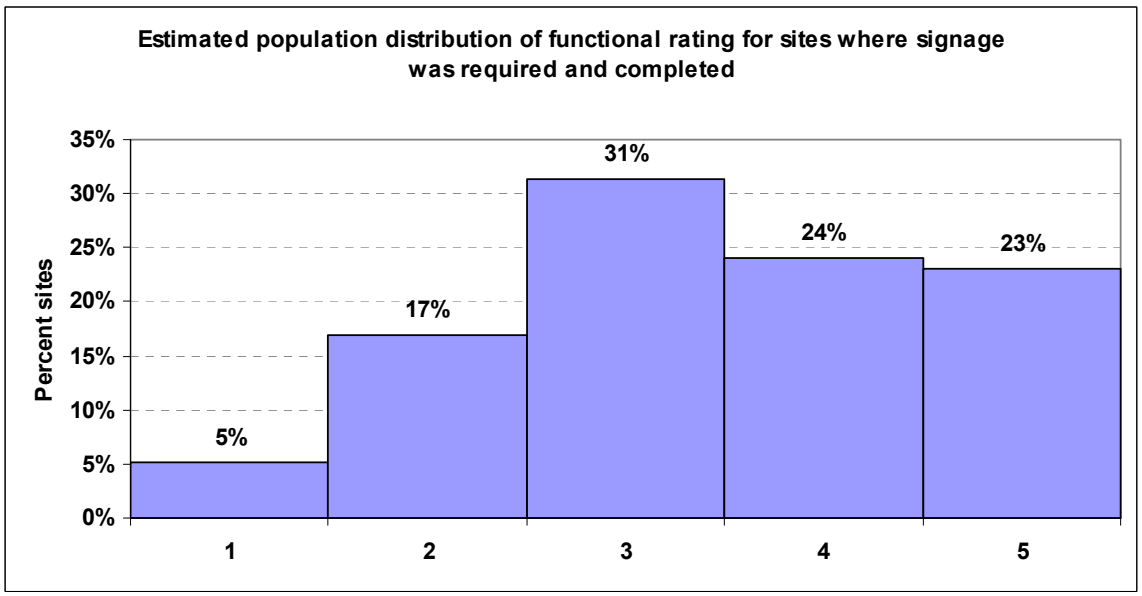

Figure 3.B-2. Estimated distribution of functional ratings for this element

Conclusions:

- Signage is likely to be completed when required for Habitat permits.
- Signage is much less likely to be completed when it is required for Wetland permits.
- When Signage is installed, it generally works well.
- Completion of Signage may slightly improve the success of the mitigation plan, particularly for Habitat permits.

Chapter 3.B.2 Related Analyses

- To Compare Success rates when EITHER Nest Boxes, LWD Placement OR Signage is required and completed see Chapter 3.K (Nest Boxes).
- For a comparison of Success rates when Access Management, Physical Demarcation or Signage is required and completed versus the presence of Human Disturbance see Chapter 6.G.2-1
- For a comparison of Success rates if Signage (S)/Access Management (AM) /Physical Demarcation (PD) were required and completed versus required and not completed see Table 3.C-7.

Chapter 3.C Access Management

Questions:

1. Was Access Management required?
2. Has it been completed when it was required?
3. Does Access Management affect success of the mitigation?
4. How well does Access Management function when it is completed?

Results:

Table 3.C-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	4	14	38	56
Not required	131	48	108	287
Total	135	62	146	343

Table 3.C-2. Population estimate for the proportion of sites where Access Management was required

Strata	Percent required	95% confidence interval
All sites (n=343)	14.02%	11.30% - 16.74%
Habitat Type I (n=135)	0.91%	0.15% - 1.67%
Habitat Types II & III (n=62)	21.13%	14.93% - 27.33%
Wetlands (n=146)	26.03%	20.20% - 31.85%

Table 3.C-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	3	11	21	35
Not completed	1	3	17	21
Total	4	14	38	56

Table 3.C-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases (n=56)	59.50%	46.24% - 72.76%
Habitat*(n=38)	78.49%	58.25% - 98.73%
Wetland* (n=18)	55.26%	39.46% - 71.06%

*The n is too small for an analysis by strata, even when grouping Habitat versus Wetlands; Wetlands are somewhat less likely to complete the access management when required (p=.09).

Table 3.C-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=56)	60.97% (47.75% - 74.20%)	46.95%(29.23% - 64.68%)
Habitat (n=18)	43.00%(26.03% - 59.97%)	45.99%(13.98% - 77.99%)
Wetland (n=38)	66.67%(50.17% - 83.17%)	47.06%(27.64% - 66.48%)

Table 3.C-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	1	1
2	-	-	1	1
3	-	3	1	4
4	-	4	5	9
5	2	4	13	19
Total	2	11	21	34

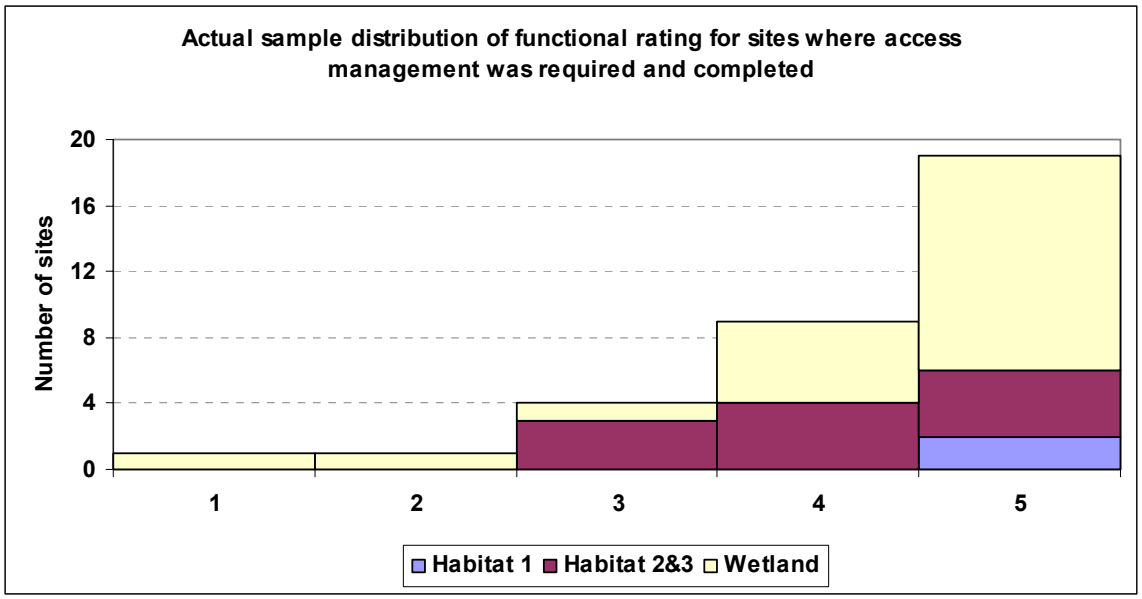

Figure 3.C-1. Actual distribution of functional ratings for this element

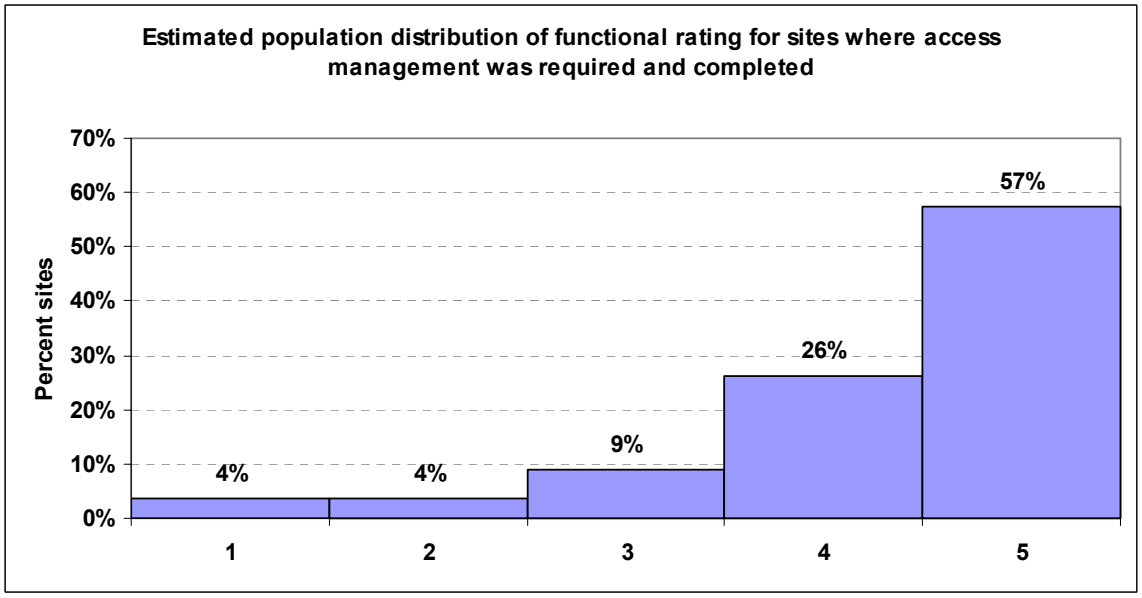

Figure 3.C-2. Estimated distribution of functional ratings for this element

Conclusions:

- Access Management is not frequently required.
- When it is required, it is less likely to be completed for Wetland permits.
- When it is required, it slightly improves the likelihood of success.
- When Access Management is required and completed, it generally performs well.

Chapter 3.C.2 Related Analyses

- For information on the success rates as a function of ratings of Buffering Averaging and Access Management for sites where both were required and completed see Chapter 3.A.2-1 (Buffer Averaging).
- For a comparison of Success rates when Access Management, Physical Demarcation or Signage is required and completed versus the presence of Human Disturbance see Table 6.G.2-1

Chapter 3.C.2-1 Effects of Different Combinations of Signage (Chapter 3.B), Access Management, and Physical Demarcation (Chapter 3.D) on Mitigation Success.

Questions:

1. Do different combinations of signage, access management, and physical demarcation have significantly different effects on mitigation success.

Results:

Table 3.C-7. Success rates if Signage (S)/Access Management(AM)/Physical Demarcation (PD) were required and completed versus required and not completed.*

Elements	Success Rate when required and completed	Success Rate when required and not completed
S	57.54% (48.44% - 66.63%)	41.47% (32.36% - 50.58%)
AM	60.97% (47.75% - 74.20%)	46.95% (29.23% - 64.68%)
PD	58.16% (50.12% - 66.20%)	22.77% (11.90% - 33.63%)
S & PD	58.73% (47.22% - 70.24%)	25.42% (13.07% - 37.76%)
S & AM	62.25% (44.98% - 79.52%)	41.67% (18.84% - 64.50%)
AM & PD	61.30% (45.91% - 76.69%)	62.59% (29.57% - 95.61%)
All three	69.22% (50.75% - 87.69%)	60% (24.86% - 95.14%)

*Large confidence intervals are due to small n for cases where multiple elements are required and completed / required and not completed.

Conclusions:

- Adding access management or physical demarcation when signage is required does not appear to increase mitigation success.

Chapter 3.D Physical Demarcation

Questions:

1. Was Physical Demarcation required?
2. Has it been completed when it was required?
3. Does Physical Demarcation affect success of the mitigation?
4. How well does Physical Demarcation function when it is completed?

Results:

Table 3.D-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	6	24	146	176
Not required	129	38	0	167
Total	135	62	146	343

Table 3.D-2. Population estimate for the proportion of sites where Physical Demarcation was required

Strata	Percent required	95% confidence interval
All sites (n=343)	48.30%	46.06% - 50.54%
Habitat type 1 (n=135)	1.37%	0.43% - 2.30%
Habitat types 2&3 (n=62)	3.58%	28.43% - 43.18%
Wetlands (n=146)	100%	100% - 100%

Table 3.D-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	4	20	74	98
Not completed	2	4	34	40
Total	6	24	108	138

Table 3.D-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases (n=138)	69.97%	63.04% - 76.91%
Habitat* (n=30)	81.11%	67.88% - 94.35%
Wetland (n=108)	68.52%	60.84% - 76.20%

*The n is too small for an analysis by strata, however we can group the Habitat strata. Wetlands are less likely to complete physical demarcation when required (p<.13).

Table 3.D-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=138)	58.16% (50.12% - 66.20%)	22.77% (11.90% - 33.63%)
Habitat* (n=30)	40.98% (28.30% - 53.66%)	13.00% (0%< - 32.59%)
Wetland (n=108)	60.81% (51.71% - 69.91%)	23.53% (11.86% - 35.20%)

*The n is too small for an analysis by strata, however we can group the Habitat strata.

Table 3.D-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	-	-
2	-	2	2	4
3	-	8	14	22
4	1	4	23	28
5	2	6	34	42
Total	3	20	73	96

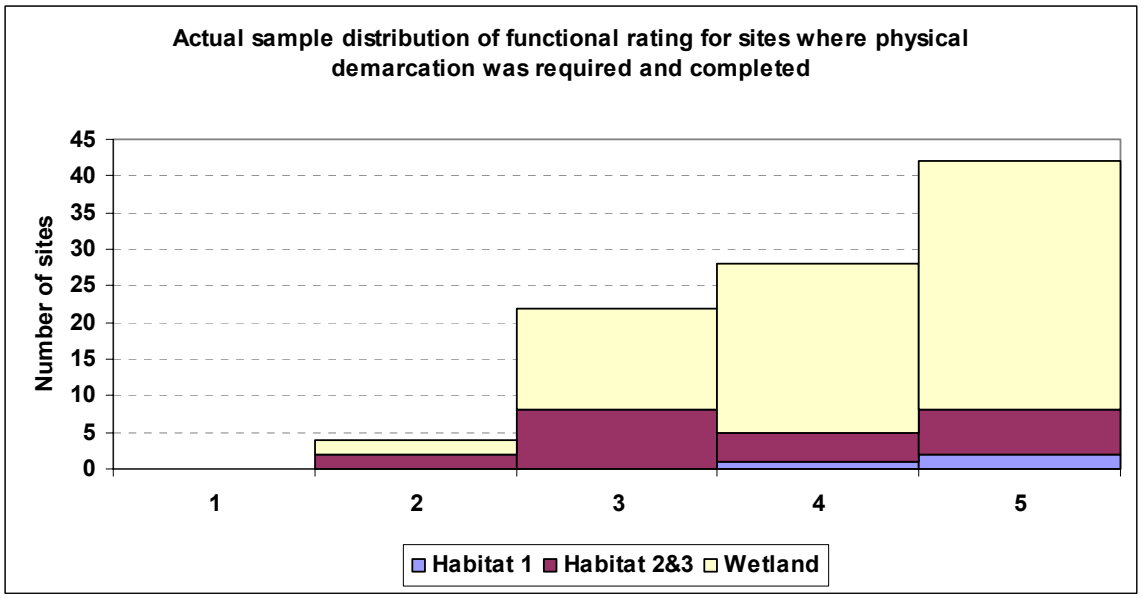

Figure 3.D-1. Actual distribution of functional ratings for this element

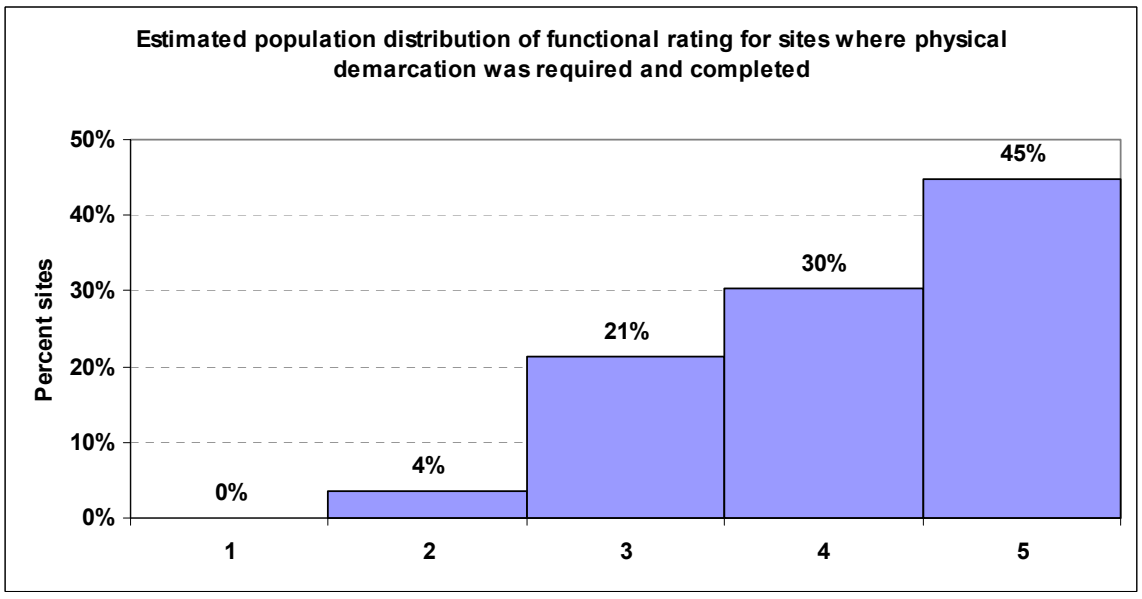

Figure 3.D-2. Estimated distribution of functional ratings for this element

Conclusions:

- Physical Demarcation is a common element of a mitigation plan.
- Physical Demarcation is generally implemented well when it is completed.
- Failure to complete Physical Demarcation, when it is required, significantly decreases the likelihood of success of the mitigation plan.

Chapter 3.D.2 Related Analyses

- For a comparison of Success rates when Access Management, Physical Demarcation or Signage is required and completed versus the presence of Human Disturbance see Table 6.G.2-1.
- For a comparison of Success rates if Signage /Access Management /Physical Demarcation were required and completed versus required and not completed see Table 3.C-7.

Chapter 3.E Maintenance plan

Questions:

1. Was a Maintenance Plan required?
2. Has it been completed when it was required?
3. Do Maintenance Plans affect success of the mitigation?
4. How well do Maintenance Plans function when they are completed?

Results:

Table 3.E-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	22	41	62	125
Not required	113	21	84	218
Total	135	62	146	343

Table 3.E-2. Population estimate for the proportion of sites where a Maintenance Plan was required

Strata	Percent required	95% confidence interval
All sites (n=343)	28.28%	24.71% - 31.84%
Habitat Type I (n=135)	7.46%	4.08% - 10.85%
Habitat Types II & III (n=62)	60.75%	52.76% - 68.73%
Wetlands (n=146)	42.47%	35.90% - 49.03%

Table 3.E-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	19	31	35	85
Not completed	3	10	25	38
Total	22	41	60	123

Table 3.E-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases (n=123)	64.89%	56.33% - 73.45%
Habitat* (n=63)	77.29%	66.21% - 88.37%
Wetland (n=60)	58.33%	46.44% - 70.23%

*The n is too small for an analysis by strata, however we can group the Habitat strata. Wetlands are less likely to complete maintenance plans when required ($p<.05$).

Table 3.E-5. Estimated mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=123)	71.18% (63.59% - 78.76%)	13.95% (4.61% - 23.29%)
Habitat* (n=63)	58.59% (48.20% - 68.97%)	6.84% (0%< - 15.03%)
Wetland (n=60)	80.00% (69.16% - 90.84%)	16.00% (4.24% - 27.76%)

*The n is too small for an analysis by strata, however we can group the Habitat strata.

Table 3.E-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	2	2
2	-	-	8	8
3	9	9	6	24
4	5	13	13	31
5	4	6	5	15
Total	18	28	34	80

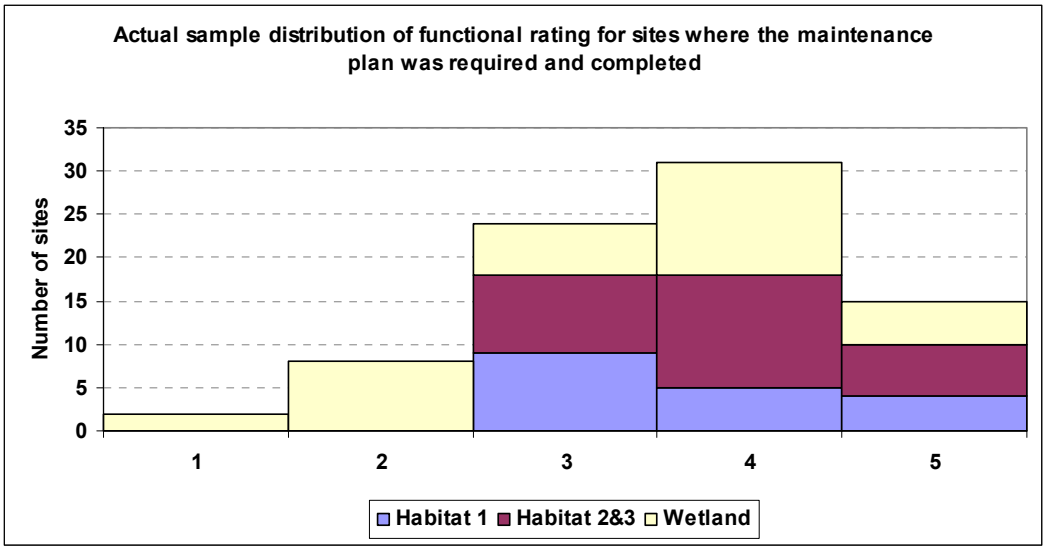

Figure 3.E-1. Actual distribution of functional ratings for this element

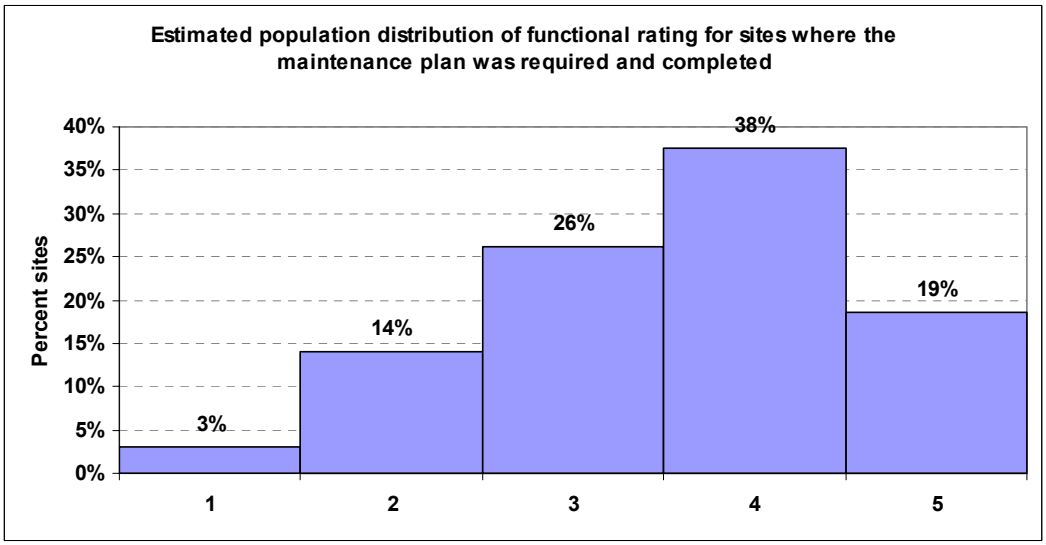

Figure 3.E-2. Estimated distribution of functional ratings for this element

Conclusions:

- Maintenance Plans are more likely to be completed when required for Habitat permits.
- Maintenance Plans generally are implemented well when they are completed, but performance is better for Habitat permits.
- Maintenance Plans significantly increase the likelihood of success when they are completed.
- When Maintenance Plans are not completed, there is a significant rate of failure of the mitigation plan.

Chapter 3.F Plantings (Plant Maintenance)

Questions:

1. Was Plant Maintenance required?
2. Has it been completed when it was required?
3. Does Plant Maintenance affect success of the mitigation?
4. How well does Plant Maintenance function when it is completed?

Results:

Table 3.F-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	126	60	132	318
Not required	9	2	14	25
Total	135	62	146	343

Table 3.F-2. Population estimate for the proportion of sites where Plantings were required

Strata	Percent required	95% confidence interval
All sites (n=343)	91.92%	89.26% - 94.58%
Habitat type 1 (n=135)	92.23%	87.81% - 96.65%
Habitat types 2&3 (n=62)	97.07%	94.58% - 99.55%
Wetlands (n=146)	90.41%	86.50% - 94.32%

Table 3.F-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	68	53	89	210
Not completed	58	7	41	106
Total	126	60	130	316

Table 3.F-4. Estimate for the proportion of cases where this element was required and completed

Strata*	Percent completed	95% confidence interval
All cases (n=316)	56.43%	51.33% - 61.53%
Type I Habitat (n=126)	38.92%	30.58% - 47.27%
Type II & III Habitat (n=60)	83.70%	76.70% - 90.70%
Wetlands (n=130)	68.46%	61.73% - 75.19%

*differences between strata are significant, p<.001.

Table 3.F-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=316)	65.06% (59.45% - 70.67%)	5.31% (2.22% - 8.40%)
Type I Habitat (n=126)	66.95% (55.53% - 78.37%)	0% (N/A)
Type II & III Habitat (n=60)	46.27% (37.82% - 54.71%)	0% (N/A)
Wetlands (n=130)	69.66% (61.85% - 77.48%)	17.07% (7.65% - 26.50%)

Table 3.F-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	7	3	3	13
2	9	9	15	33
3	11	11	12	34
4	17	21	31	69
5	19	8	23	50
Total	63	52	84	199

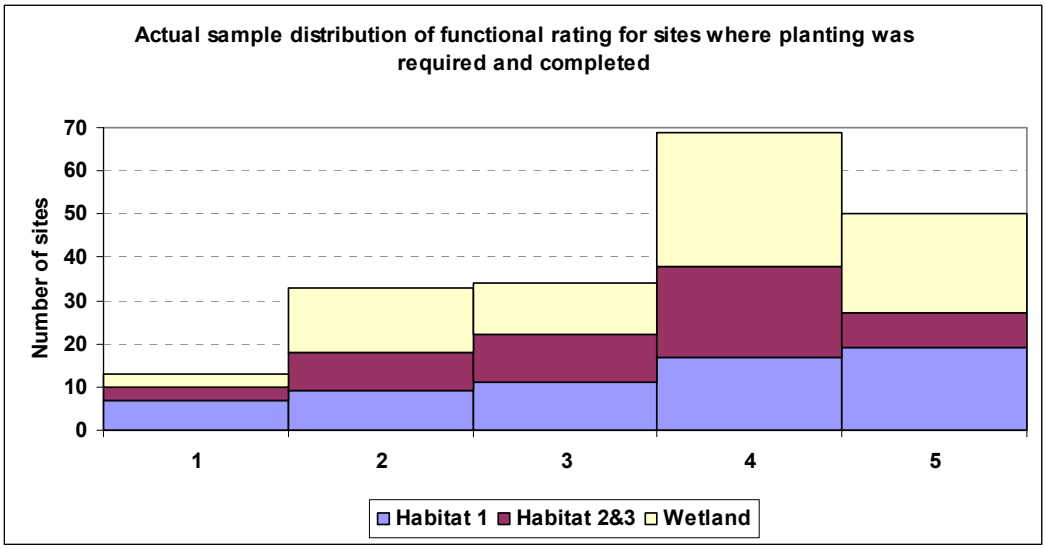

Figure 3.F-1. Actual distribution of functional ratings for this element

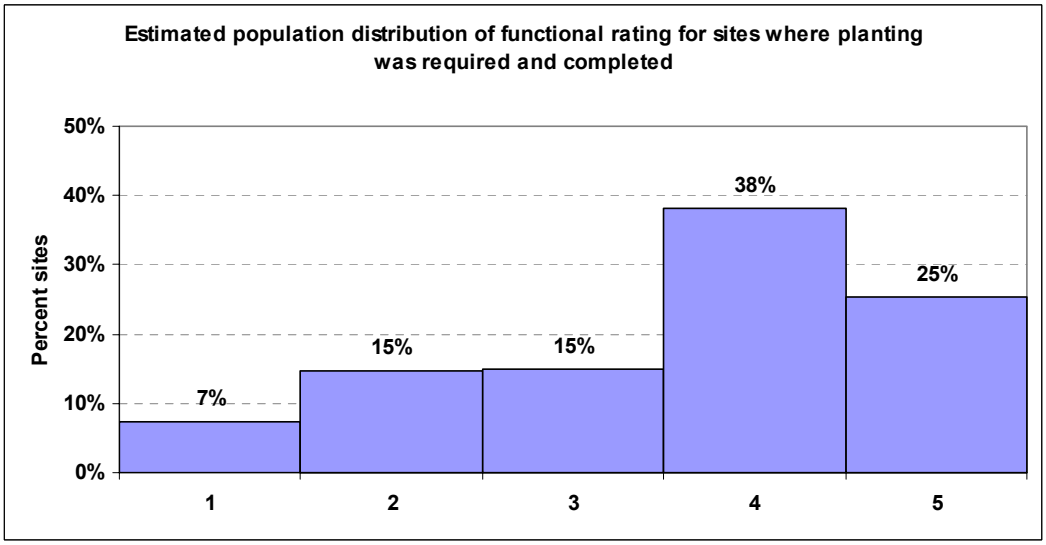

Figure 3.F-2. Estimated distribution of functional ratings for this element

Conclusions:

- Plant Maintenance is a common element of a mitigation plan and is completed most of the time for Wetland permits and Type II and III Habitat permits.
- Plant Maintenance is much less likely to be completed for Type I Habitat permits.
- Plant Maintenance is usually implemented fairly well when it is completed.
- Completion of Plant Maintenance increases the rate of success, especially for Habitat permits.
- Failure to complete Plant Maintenance, when it is required, significantly decreases the likelihood of success of the mitigation plan.

Chapter 3.F.2 Related Analyses

- For an analysis of the success of mitigation across the distribution of tree and shrub canopy coverage by the functional rating of the Plantings Element see Chapter5.E.2-1

Chapter 3.F.2-1 Mitigation Success Rates by Plantings Functional Rating of Plantings for Tree and Shrub Canopy Coverage Classes.

Questions:

1. How does the rate of mitigation success change with plant maintenance performance for each coverage class in the tree and shrub layers?

Results:

Table 3.F-7. Success rates as a function of Plantings functional rating (horizontal) and canopy cover rating for trees (vertical).

Tree Coverage	Functional Rating*				
	1	2	3	4	5
0-5%	0% (6)	7% (14)	18% (11)	88% (16)	93% (14)
5-25%	0% (2)	0% (8)	38% (8)	88% (16)	89% (19)
25-50%	0% (1)	33% (3)	67% (6)	100% (11)	100% (4)
50-75%	-	0% (4)	80% (5)	65% (20)	100% (9)
75-95%	-	-	100% (1)	100% (1)	100% (3)
95-100%	-	-	-	-	-

*Actual n in parenthesis.

Table 3.F-8. Success rates as a function of Plantings functional rating (horizontal) and canopy cover rating for shrubs (vertical).

Shrub Coverage	Functional Rating*				
	1	2	3	4	5
0-5%	0% (3)	11% (9)	0% (8)	73% (11)	100% (5)
5-25%	0% (1)	8% (12)	63% (16)	65% (17)	80% (15)
25-50%	-	0% (3)	100% (2)	82% (17)	100% (11)
50-75%	-	0% (1)	100% (2)	89% (9)	100% (3)
75-95%	-	-	100% (1)	100% (1)	100% (2)
95-100%	0% (1)	-	-	-	-

*Actual n in parenthesis.

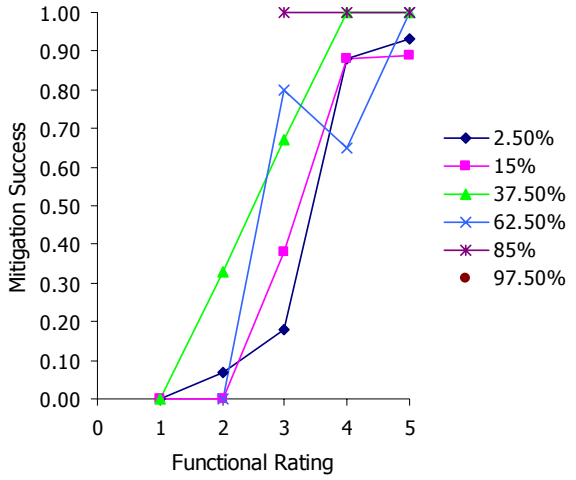

Figure 3.F.3. Mitigation Success Rate as a vs. Functional rating for Tree Coverage Classes

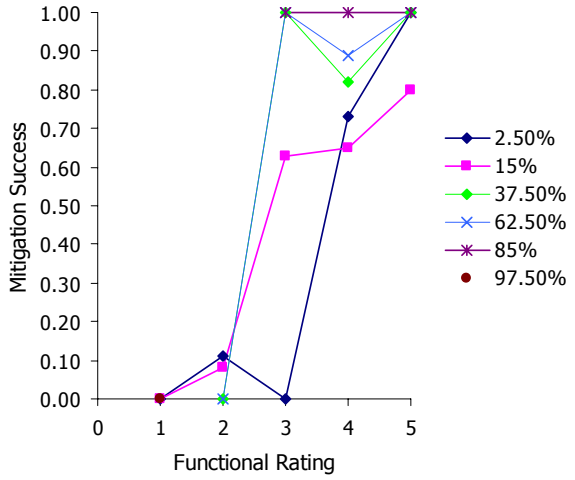

Figure 3.F.4. Mitigation Success Rate as a vs. Functional rating for Shrub Coverage Classes

Conclusions:

- The trend in observed success rates as plant maintenance performance increases does not vary significantly by coverage class in the tree and shrub layers.

Chapter 3.F.2-2 Mitigation Success Rates by Plantings Functional Rating of Plantings for Tree and Shrub Height Classes.

Questions:

1. How does the rate of mitigation success change with plant maintenance performance for each height class in the tree and shrub layers?

Results:

Table 3.F-9. Success rates as a function of Plantings functional rating (horizontal) and average height of mitigation plantings for trees (vertical).

Trees	Functional Rating*				
	1	2	3	4	5
0-5	0% (4)	0% (11)	10% (10)	56% (16)	67% (9)
5-10	0% (3)	0% (12)	44% (9)	71% (21)	94% (18)
10-15	0% (1)	33% (3)	83% (6)	100% (14)	100% (16)
15+	-	20% (5)	57% (7)	93% (14)	100% (7)

*Actual n in parenthesis.

Table 3.F-10. Success rates as a function of Plantings functional rating (horizontal) and average height of mitigation plantings for shrubs (vertical).

Shrubs	Functional Rating*				
	1	2	3	4	5
0-5	0% (2)	8.33% (12)	31% (13)	65% (26)	84% (19)
5-10	-	0% (6)	80% (10)	88% (24)	100% (12)
10-15	-	0% (2)	67% (3)	100% (3)	100% (3)
15+	-	-	-	-	100% (1)

*Actual n in parenthesis.

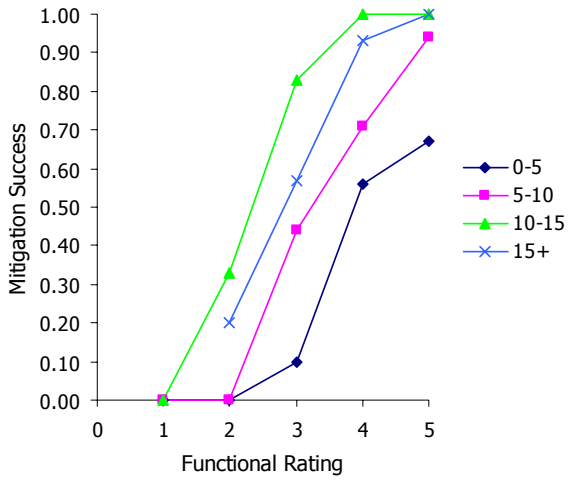

Figure 3.F-5. Mitigation Success Rate as a vs. Functional rating for Tree Height Classes

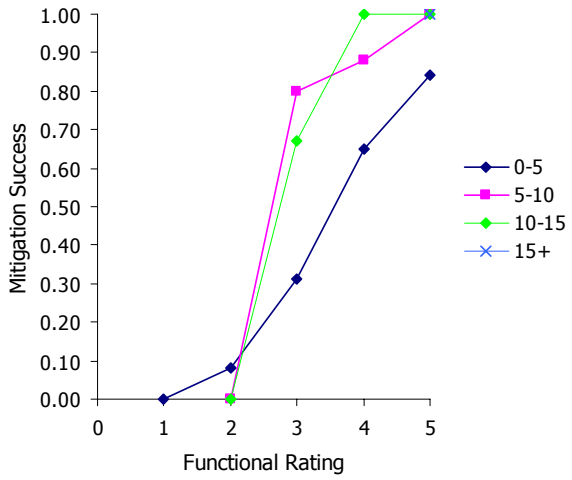

Figure 3.F-6. Mitigation Success Rate as a vs. Functional rating for Shrub Height Classes

Conclusions:

- The trend in observed success rates as plant maintenance performance increases does not vary significantly by height class in the tree and shrub layers.

Chapter 3.G Plant Protection

Questions:

1. Was Plant Protection required?
2. Has it been completed when it was required?
3. Does Plant Protection affect success of the mitigation?
4. How well does Plant Protection function when it is completed?

Results:

Table 3.G-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	20	27	28	75
Not required	115	35	118	268
Total	135	62	146	343

Table 3.G-2. Population estimate for the proportion of sites where Plant Protection was required

Strata	Percent required	95% confidence interval
All sites (n=343)	15.35%	12.52% - 18.18%
Habitat Type I (n=135)	6.19%	3.27% - 9.11%
Habitat Types II & III (n=62)	40.21%	32.61% - 47.80%
Wetlands (n=146)	19.18%	13.95% - 24.40%

Table 3.G-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	9	18	13	40
Not completed	10	8	14	32
Total	19	26	27	72

Table 3.G-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases (n=72)	54.83%	42.51% - 67.15%
Habitat* (n=45)	63.50%	49.68% - 77.32%
Wetland (n=27)	48.15%	28.66% - 67.64%

*The n is too small for an analysis by strata, however we can group the Habitat strata. Wetlands are less likely to complete plant protection when required (p<.19).

Table 3.G-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=72)	70.89% (59.66% - 82.13%)	46.58% (31.57% - 61.59%)
Habitat* (n=45)	64.96% (52.05% - 77.88%)	40.28% (23.89% - 56.67%)
Wetland (n=27)	76.92% (58.18% - 95.67%)	50.00% (28.57% - 71.43%)

*The n is too small for an analysis by strata, however we can group the Habitat strata.

Table 3.G-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	-	0
2	-	-	2	2
3	3	4	-	7
4	3	11	8	22
5	2	3	1	6
Total	8	18	11	37

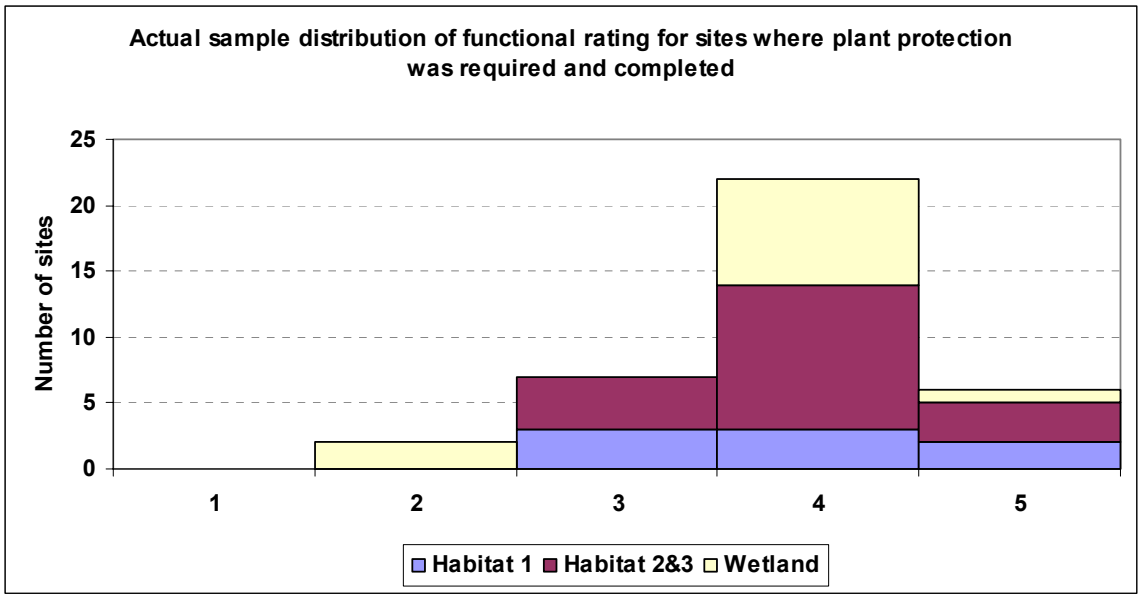

Figure 3.G-1. Actual distribution of functional ratings for this element

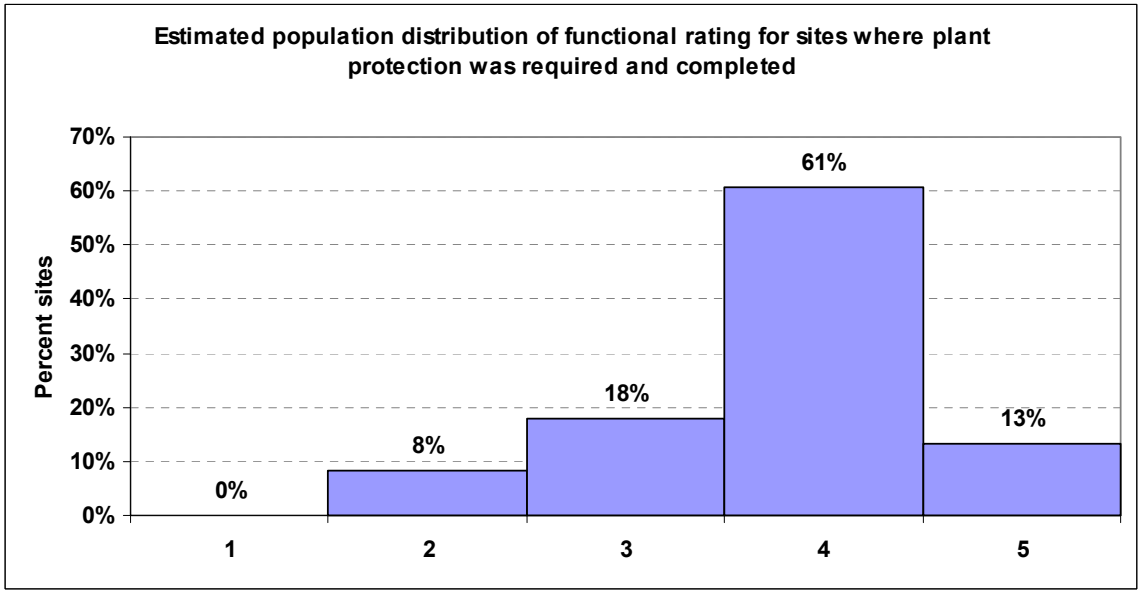

Figure 3.G-2. Estimated distribution of functional ratings for this element

Conclusions:

- Plant Protection is more likely to be completed when required for Habitat permits vs. Wetland permits.
- Plant Protection is generally implemented well when it is completed.
- Plant Protection significantly increases the likelihood of success of the mitigation plan.

Chapter 3.G.2 Related Analyses

Chapter 3.G.2-1 Mitigation Success Rates by Plant Protection Functional Rating of Plant Protection for Tree and Shrub Canopy Coverage Classes.

Questions:

1. How does the rate of mitigation success change with plant protection performance for each coverage class in the tree and shrub layers?

Results:

Table 3.G-7. Success rates as a function of Plant Protection functional rating (horizontal) and canopy cover rating for trees (vertical).

Trees	Functional Rating*				
	1	2	3	4	5
0-5%	-	-	33% (3)	100% (1)	100% (2)
5-25%	-	-	0% (1)	67% (3)	100% (2)
25-50%	-	-	100% (2)	100% (3)	-
50-75%	-	-	-	77% (13)	100% (1)
75-95%	-	-	-	-	-
95-100%	-	-	-	-	-

*Actual n in parenthesis.

Table 3.G-8. Success rates as a function of Plant Protection functional rating (horizontal) and canopy cover rating for shrubs (vertical).

Shrubs	Functional Rating*				
	1	2	3	4	5
0-5%	-	-	50% (2)	33% (3)	100% (2)
5-25%	-	-	50% (4)	50% (8)	0% (1)
25-50%	-	0% (2)	-	100% (7)	100% (1)
50-75%	-	-	-	100% (4)	-
75-95%	-	-	-	-	-
95-100%	-	-	-	-	-

*Actual n in parenthesis.

Conclusions:

- There is not enough data to draw any conclusions regarding the relationship between plant protection and canopy coverage.

Chapter 3.G.2-2 Mitigation Success Rates by Plantings Functional Rating of Plant Protection Tree and Shrub Height Coverage Classes.

Questions:

1. How does the rate of mitigation success change with plant protection performance for each height class in the tree and shrub layers?

Results:

Table 3.G-9. Success rates as a function of Plant Protection functional rating (horizontal) and average height of mitigation plantings for trees (vertical).

TREES	Functional Rating for*				
	1	2	3	4	5
0-5	-	-	0% (3)	100% (1)	50% (2)
5-10	-	0% (2)	50% (2)	40% (10)	100% (3)
10-15	-	-	100% (2)	100% (8)	100% (1)
15+	-	-	-	100% (3)	-

*Actual n in parenthesis.

Table 3.G-10. Success rates as a function of Plant Protection functional rating (horizontal) and average height of mitigation plantings for shrubs (vertical).

SHRUBS	Functional Rating*				
	1	2	3	4	5
0-5	-	-	33% (3)	60% (10)	80% (5)
5-10	-	-	0% (1)	82% (11)	-
10-15	-	-	100% (1)	100% (1)	-
15+	-	-	-	-	-

*Actual n in parenthesis.

Conclusions:

- There is not enough data to draw any conclusions regarding the relationship between plant protection and height class.

Chapter 3.H Irrigation

Questions:

1. Was Irrigation required?
2. Has it been completed when it was required?
3. Does Irrigation affect success of the mitigation?
4. How well does Irrigation function when it is completed

Results:

Table 3.H-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	12	38	60	110
Not required	123	24	86	233
Total	135	62	146	343

Table 3.H-2. Population estimate for the proportion of sites where Irrigation was required

Strata	Percent required	95% confidence interval
All sites (n=343)	26.18%	22.73% - 29.63%
Habitat Type I (n=135)	5.18%	2.04% - 8.33%
Habitat Types II & III (n=62)	56.34%	48.36% - 64.33%
Wetlands (n=146)	41.10%	34.57% - 47.63%

Table 3.H-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	9	22	20	51
Not completed	3	9	33	45
Total	12	31	53	96

Table 3.H-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases (n=96)	47.98%	38.15% - 57.81%
Wetland (n=53)	37.74%	25.12% - 50.35%
Habitat*(n=43)	71.25%	56.01% - 86.49%

*The n is too small for an analysis by strata, however we can group the Habitat strata. Wetlands are less likely to complete irrigation when required ($p<.01$).

Table 3.H-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=96)	77.86% (69.83% - 85.90%)	21.39% (11.26% - 31.51%)
Wetlands (n=53)	90.00% (79.24% - >100%)	24.24% (12.28% - 36.21%)
Habitats* (n=43)	63.26% (50.76% - 75.77%)	7.34% (0%< - 16.17%)

*The n is too small for an analysis by strata, however we can group the Habitat strata.

Table 3.H-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	-	-
2	-	-	-	-
3	3	1	-	4
4	2	12	6	20
5	3	8	14	25
Total	8	21	20	49

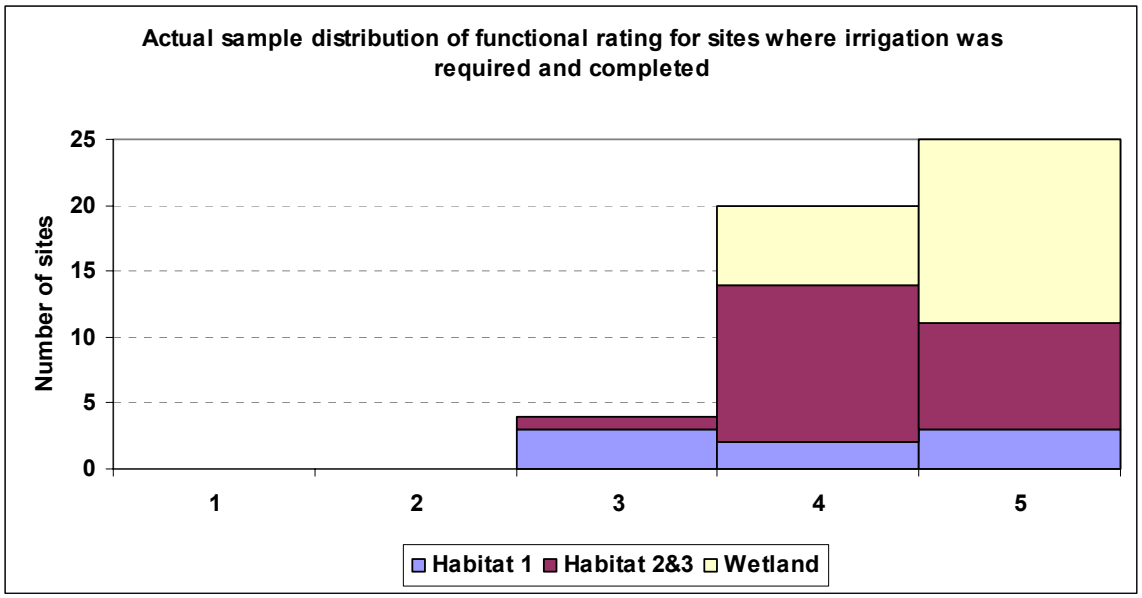

Figure 3.H-1. Actual distribution of functional ratings for this element

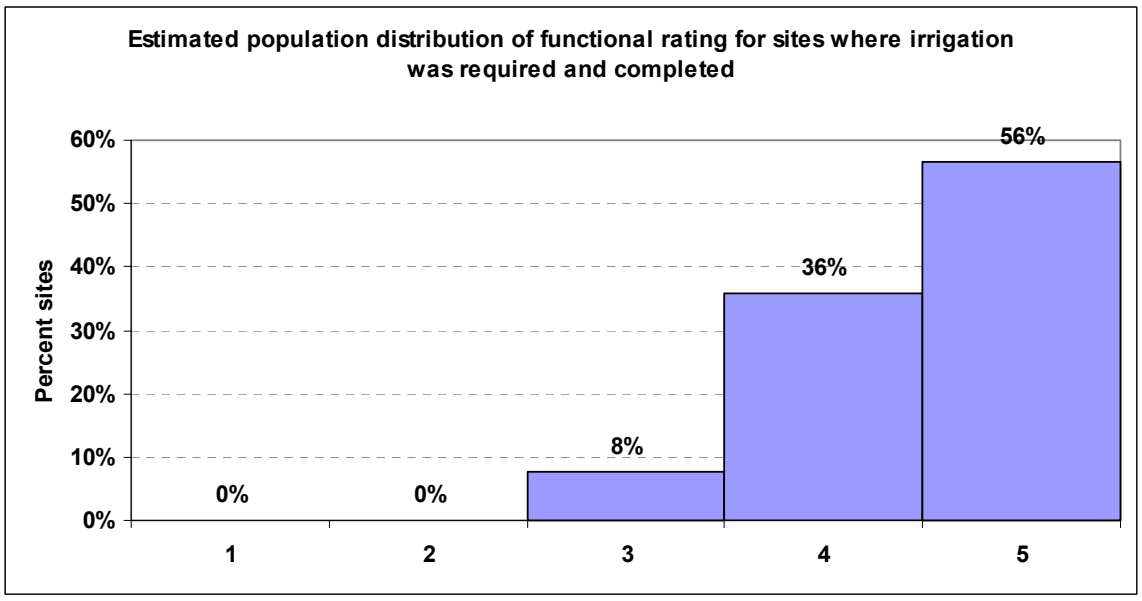

Figure 3.H-2. Estimated distribution of functional ratings for this element

Conclusions:

- Irrigation is likely to be completed when required for Habitat permits.
- Irrigation is not likely to be completed when it is required for Wetland permits.
- Irrigation works well when it is completes.
- Irrigation increases the likelihood of success when completed.

Chapter 3.H.2 Related Analyses

Chapter 3.H.2-1 Mitigation Success Rates by Irrigation Functional Rating of Plant Protection for Tree and Shrub Canopy Coverage Classes.

Questions:

1. How does the rate of mitigation success change with irrigation performance for each coverage class in the tree and shrub layers?

Results:

Table 3.H-7. Success rates as a function of Irrigation functional rating (horizontal) and canopy cover rating for trees (vertical).

TREES	Functional Rating*				
	1	2	3	4	5
0-5%	-	-	0% (1)	100% (5)	63% (8)
5-25%	-	-	0% (1)	80% (5)	83% (6)
25-50%	-	-	100% (2)	50% (2)	100% (2)
50-75%	-	-	-	40% (5)	100% (6)
75-95%	-	-	-	-	100% (1)
95-100%	-	-	-	-	-

*Actual n in parenthesis.

Table 3.H-8. Success rates as a function of Irrigation functional rating (horizontal) and canopy cover rating for shrubs (vertical).

SHRUBS	Functional Rating*				
	1	2	3	4	5
0-5%	-	-	0% (1)	67% (6)	60% (5)
5-25%	-	-	67% (3)	44% (9)	71% (7)
25-50%	-	-	-	100% (3)	100% (6)
50-75%	-	-	-	100% (1)	100% (3)
75-95%	-	-	-	-	-
95-100%	-	-	-	-	-

*Actual n in parenthesis.

Conclusions:

- There is not enough data to draw any conclusions regarding the relationship between irrigation and canopy coverage.

Chapter 3.H.2-2 Mitigation Success Rates by Irrigation Functional Rating of Plant Protection Tree and Shrub Height Coverage Classes.

Questions:

1. How does the rate of mitigation success change with irrigation performance for each height class in the tree and shrub layers?

Results:

Table 3.H-9. Success rates as a function of Irrigation functional rating (horizontal) and average height of mitigation plantings for trees (vertical).

TREES	Functional Rating*				
	1	2	3	4	5
0-5	-	-	-	-	44% (9)
5-10	-	-	0% (1)	33% (9)	100% (7)
10-15	-	-	100% (2)	90% (10)	100% (4)
15+	-	-	0% (1)	0% (1)	100% (4)

*Actual n in parenthesis.

Table 3.H-10. Success rates as a function of Irrigation functional rating (horizontal) and average height of mitigation plantings for shrubs (vertical).

SHRUBS	Functional Rating*				
	1	2	3	4	5
0-5	-	-	0% (1)	38% (8)	73% (15)
5-10	-	-	-	73% (11)	100% (5)
10-15	-	-	50% (2)	100% (1)	100% (1)
15+	-	-	-	-	-

*Actual n in parenthesis.

Conclusions:

- There is not enough data to draw any conclusions regarding the relationship between irrigation and canopy coverage.

Chapter 3.I Invasive Control

Questions:

1. Was Invasive Control required?
2. Has it been completed when it was required?
3. Does Invasive Control affect success of the mitigation?
4. How well does Invasive Control function when it is completed?

Results:

Table 3.I-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	54	47	119	220
Not required	81	15	27	123
Total	135	62	146	343

Table 3.I-2. Population estimate for the proportion of sites where Invasive Control was required

Strata	Percent required	95% confidence interval
All sites (n=343)	56.07%	51.68% - 60.47%
Type I Habitat (n=135)	28.63%	21.51% - 35.75%
Types II & III Habitat (n=62)	69.63%	61.82% - 77.43%
Wetlands (n=146)	81.51%	76.35% - 86.66%

Table 3.I-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	35	35	68	138
Not completed	19	12	48	79
Total	54	47	116	217

Table 3.I-4. Estimate for the proportion of cases where this element was required and completed

Strata*	Percent completed	95% confidence interval
All cases (n=217)	57.43%	51.07% - 63.79%
Type I Habitat (n=54)	44.96%	29.32% - 60.60%
Type II & III Habitat (n=47)	74.72%	65.46% - 83.97%
Wetland (n=116)	58.62%	50.87% - 66.37%

*Differences between strata are significant, p<.05.

Table 3.I-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=217)	69.90% (63.47% - 76.32%)	10.91% (5.37% - 16.45%)
Type I Habitat (n=54)	57.23%(39.54% - 74.92%)	0% (N/A)
Type II & III Habitat (n=47)	52.74% (42.41% - 63.08%)	8.33% (0%< - 17.99%)
Wetland (n=116)	77.94% (69.88% - 86.01%)	16.67% (8.04% - 25.29%)

Table 3.I-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	-	-
2	2	2	4	8
3	13	16	16	45
4	11	7	31	49
5	5	9	16	30
Total	31	34	67	132

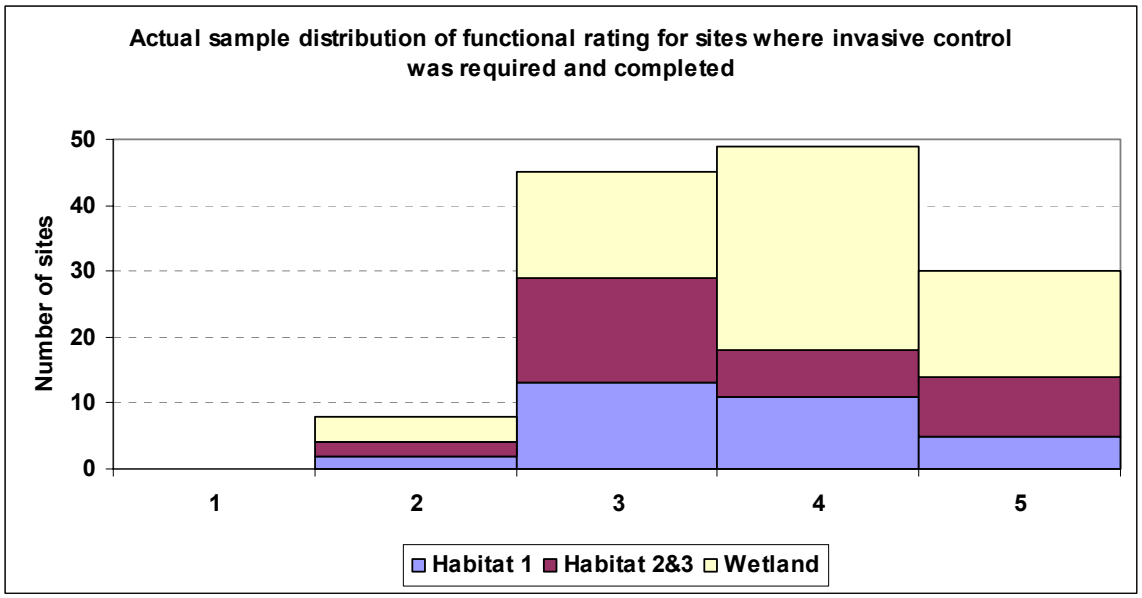

Figure 3.I-1. Actual distribution of functional ratings for this element

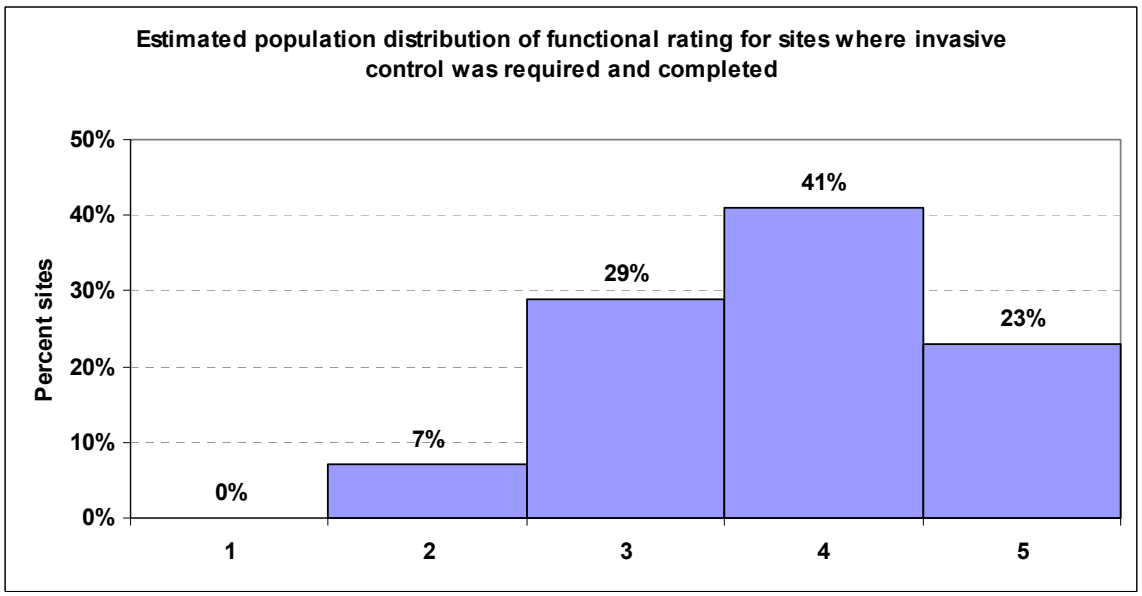

Figure 3.I-2. Estimated distribution of functional ratings for this element

Conclusions:

- Invasive Control is a common element of a mitigation plan and is completed in more than half the cases.
- Invasive Control is generally implemented fairly well when it is completed.
- Completion of Invasive Control increases the rate of success, especially for Wetland permits.
- Failure to complete Invasive Control, when it is required, significantly decreases the likelihood of success of the mitigation plan.

Chapter 3.I.2 Related Analyses

Chapter 3.I.2-1 Invasive Control Functional rating as a Function of Invasive Species Coverage Class

Questions:

1. Does performance of invasive control correlate with invasive species coverage on the site?

Results:

Table 3.I-7. Distribution of Invasive Control functional rating for cases required and completed (horizontal) versus area coverage by invasive species (vertical).

Coverage Class	Functional Rating					Total
	1	2	3	4	5	
0-5%	-	-	5	12	18	35
5-25%	-	1	8	19	9	37
25-50%	-	4	16	11	1	32
50-75%	-	1	7	2	1	11
75-95%	-	2	9	5	-	16
95-100%	-	-	-	-	1	1
Total	-	8	45	49	30	132

Conclusions:

- Sites with better invasive control generally have lower coverage of invasive species.

Chapter 3.J Large Woody Debris (LWD) Placement

Questions:

1. Was LWD Placement required?
2. Has it been completed when it was required?
3. Does LWD Placement affect success of the mitigation?
4. How well does LWD Placement function when it is completed?

Results:

Table 3.J-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	7	18	30	55
Not required	128	44	116	288
Total	135	62	146	343

Table 3.J-2. Population estimate for the proportion of sites where LWD Placement was required

Strata	Percent required	95% confidence interval
All sites (n=343)	13.20%	10.45% - 15.96%
Habitat Type I (n=135)	3.23%	0.67% - 5.78%
Habitat Types II & III (n=62)	26.41%	19.76% - 33.06%
Wetlands (n=146)	20.55%	15.18% - 25.91%

Table 3.J-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	7	15	20	42
Not completed	-	3	8	11
Total	7	18	28	53

Table 3.J-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases (n=53)	77.31%	65.35% - 89.27%
Wetland (n=28)	71.43%	54.19% - 88.67%
Habitat* (n=25)	89.27%	78.11% - >100%

*The n is too small for an analysis by strata, however we can group the Habitat strata. Wetlands are less likely to complete LWD placements when required (p<.08).

Table 3.J-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=53)	60.88% (48.48% - 73.28%)	63.15% (39.48% - 86.82%)
Wetland (n=28)	60.00% (42.43% - 77.57%)	62.50% (35.05% - 89.95%)
Habitat* (n=25)	62.31% (46.68% - 77.95%)	66.67% (33.71% - 99.62%)

*The n is too small for an analysis by strata, however we can group the Habitat strata.

Table 3.J-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total
1	-	-	-	-
2	-	1	3	4
3	-	-	3	3
4	4	3	1	8
5	2	11	13	26
Total	6	15	20	41

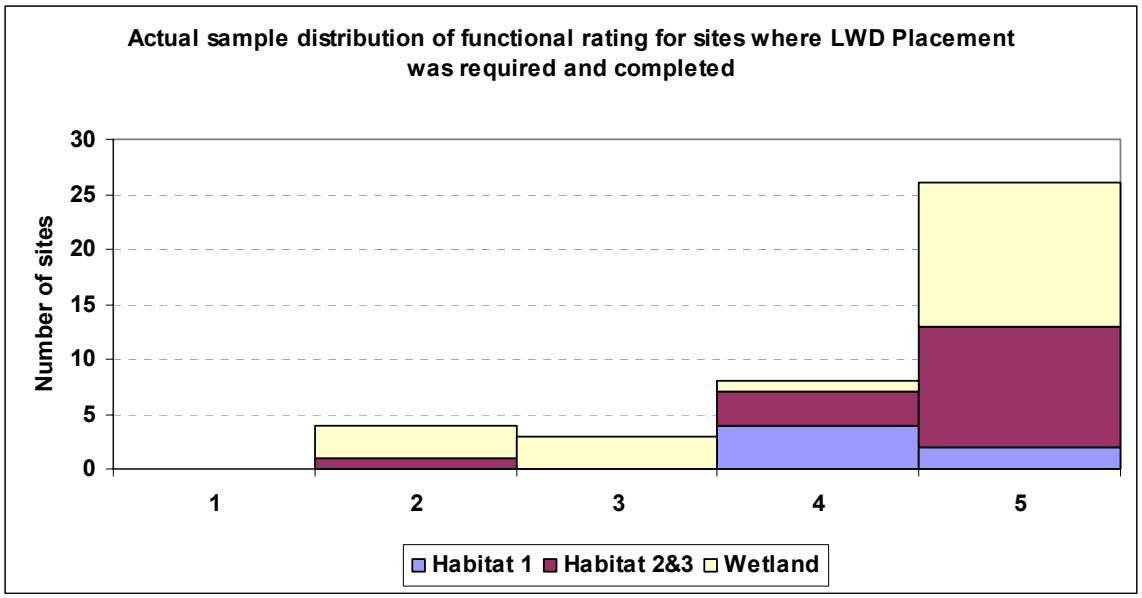

Figure 3.J-1. Actual distribution of functional ratings for this element

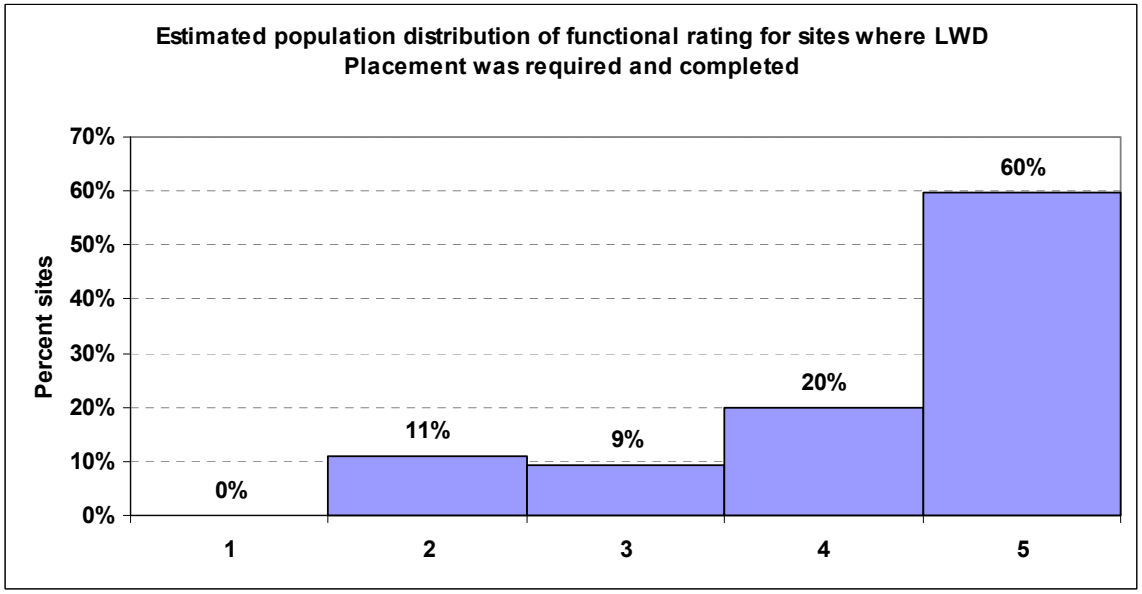

Figure 3.J-2. Estimated distribution of functional ratings for this element

Conclusions:

- LWD Placement is not commonly required in mitigation plans.
- LWD Placement is likely to be completed when required.
- LWD Placement is generally implemented well when completed.
- LWD Placement has no affect on likelihood of success when they are completed.
- LWD can function long-term despite mitigation plan failure.

Chapter 3.J.2 Related Analyses

- To Compare Success rates when EITHER Nest Boxes, LWD Placement or Snags is required and completed see Chapter 3.K.2 (Nest Boxes).

Chapter 3.K Nest Boxes

Questions:

1. Were Nest Boxes required?
2. Have they been completed when they were required?
3. Do Nest Boxes affect success of the mitigation?
4. How well do Nest Boxes function when it is completed?

Results:

Table 3.K-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	2	8	18	28
Not required	133	54	128	315
Total	135	62	146	343

Table 3.K-2. Population estimate for the proportion of sites where Nest Boxes were required

Strata	Percent required	95% confidence interval
All sites (n=343)	7.20%	5.06% - 9.35%
Habitat Type I (n=135)	1.28%	0% < - 3.03%
Habitat Types II & III (n=62)	11.74%	6.97% - 16.51%
Wetlands (n=146)	12.33%	7.96% - 16.69%

Table 3.K-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	2	5	5	12
Not completed	-	3	13	16
Total	2	8	18	28

Table 3.K-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases* (n=28)	39.35%	20.65% - 58.06%

*The n is too small for an analysis by strata.

Table 3.K-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=28)	57.74% (34.37% - 81.12%)	51.75% (31.56% - 71.95%)
Wetland (n=18)	60.00% (24.86% - 95.14%)	53.85% (31.67% - 76.02%)
Habitat* (n=10)	55.18% (23.85% - 86.51%)	33.33% (0.38% - 66.29%)

*The n is too small for an analysis by strata, however we can group the Habitat strata.

Table 3.K-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total

1	-	-	-	-
2	-	1	-	1
3	-	1	2	3
4	-	1	2	3
5	2	2	-	4
Total	2	5	4	11

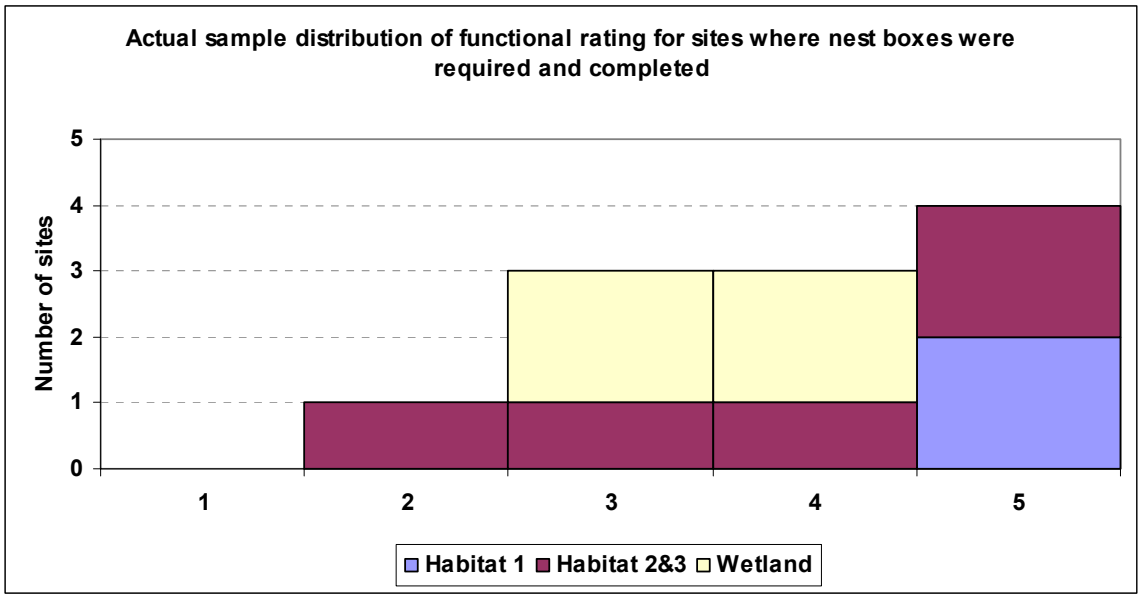

Figure 3.K-1. Actual distribution of functional ratings for this element

The n is too small for population estimates of the distribution of functional ratings for cases that were required to complete and did complete the element.

Conclusions:

- Nest Boxes are not commonly included in mitigation plans.
- Nest Boxes are generally implemented well when completed.
- Nest Boxes do not appear to affect the success of the mitigation plan.
- Nest Boxes can function long-term despite mitigation plan failure.

Chapter 3.K.2 Related Analyses

Chapter 3.K.2-1 Mitigation Success Rate when Nest Boxes, Large Woody Debris, or Signage was required and completed

Questions:

1. Do specific habitat structural elements increase the likelihood of mitigation success?

Results:

Table 3.K-7 Success rates when eihter Nest Boxes, LWD Placement or Signage are required and completed (n=104)*

59.43% (51.58% - 67.28%)

*Note: we cannot compare this success rate to the success rate when at least one of the three is not completed, because the two categories would overlap (one required element may be completed and another required element may not).

Did we want Snag Presence instead of Signage?

Conclusions:

- Adding elements that provide habitat structure do not improve the likelihood that mitigation will succeed.

Chapter 3.L Snag Presence

Questions:

1. Was Snag Presence required?
2. Has it been completed when it was required?
3. Does Snag Presence affect success of the mitigation?
4. How well does Snag Presence function when it is completed?

Results:

Table 3.L-1. Cases where this element was required (actual data samples)

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	4	12	18	34
Not required	131	50	128	309
Total	135	62	146	343

Table 3.L-2. Population estimate for the proportion of sites where Snag Presence was required

Strata	Percent required	95% confidence interval
All sites (n=343)	7.63%	5.58% - 9.69%
Habitat Type I (n=135)	0.91%	0.15% - 1.67%
Habitat Types II & III (n=62)	17.61%	11.92% - 23.29%
Wetlands (n=146)	12.33%	7.96% - 16.69%

Table 3.L-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	2	10	9	21
Not completed	2	2	9	13
Total	4	12	18	34

Table 3.L-4. Estimate for the proportion of cases where this element was required and completed

Strata	Percent completed	95% confidence interval
All cases*(n=34)	57.79%	39.57% - 76.01%

*The n is too small for an analysis by strata.

Table 3.L-5. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases (n=34)	52.42% (34.71% - 70.13%)	49.93% (26.88% - 72.98%)
Habitat* (n=16)	47.39% (29.38% - 65.40%)	79.37% (49.78% - >100%)
Wetland (n=18)	55.56% (28.99% - 82.12%)	44.44% (17.88% - 71.01%)

*The n is too small for an analysis by strata.

Table 3.L-6. Actual distribution of functional rating for this element when it is required and completed

Rating	Type I Habitat	Type II & III Habitat	Wetland	Total

1	-	-	-	-
2	-	-	-	-
3	-	-	1	1
4	1	1	2	4
5	1	9	6	16
Total	2	10	9	21

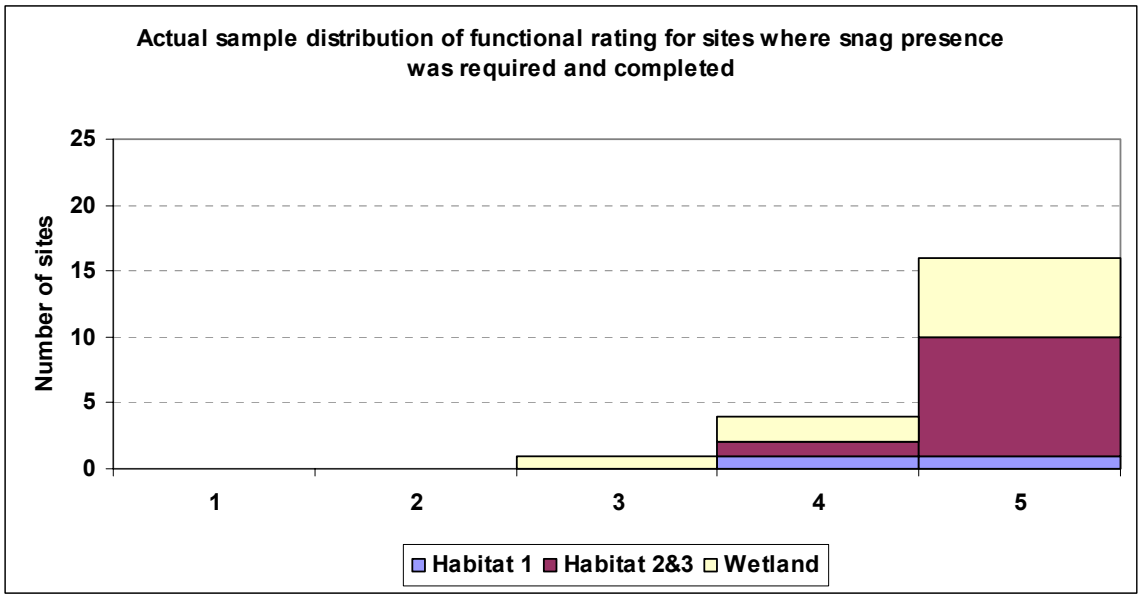

Figure 3.L-1. Actual distribution of functional ratings for this element

The n is too small for population estimates of the distribution of functional ratings for cases that were required to complete and did complete the element.

Conclusions:

- Snag Presence is not a comment element of mitigation plans.
- When it is required, it is completed about half the time.
- When Snag Presence is completed, it generally works well.
- No correlation between completion or performance of Snag Presence and success of the mitigation plan was observed.
- Snags can function long-term despite mitigation plan failure.

Chapter 3.M Hydrologic Monitoring

Questions:

1. Was hydrologic monitoring required?
2. Has it been completed when it was required?
3. Does hydrologic monitoring affect success of the mitigation?
4. How well does hydrologic monitoring function when it is completed?

Results:

Table 3.M-1. Cases where this element was required (actual data samples)

	Type I Habitat	Type II and III Habitat	Wetland	Total
Required	-	-	9	9
Not required	135	62	137	334
Total	135	62	146	343

Table 3.M-2. Population estimate for the proportion of sites where Hydrologic Monitoring was required

	Percent required	95% confidence interval
All sites (n=343)	2.72%	1.31% - 4.12%
Habitat Type I (n=135)	0%	N/A
Habitat Types II & III (n=62)	0%	N/A
Wetlands (n=146)	6.16%	2.97% - 9.36%

Table 3.M-3. Data for cases where this element was required

Status	Type I Habitat	Type II and III Habitat	Wetland	Total
Completed	-	-	3	3
Not completed	-	-	6	6
Total	-	-	9	9

No population estimates were generated due to the small number of cases.

Table 3.M-4. Estimated Mitigation success rates when this element is required

Strata	Required & Completed	Required & Not Completed
All cases* (n=9)	100%	66.67% (35.80% - 97.53%)

*All cases are Wetland cases

The functional distribution was not analyzed due to the small number of cases.

Conclusions:

- Hydrologic Monitoring is generally not required.
- There is not enough data on Hydrologic Monitoring to make further conclusions.

Chapter 4 Mitigation Siting

Questions:

1. Was the mitigation installed in location specified in the approved plan?
2. Was the approved mitigation site appropriate?
3. If the mitigation was relocated, was the selected site more appropriate than the approved site?

Results:

Table 3-1. Was the mitigation installed as prescribed? Population Estimates

Strata*	Estimate	95% confidence interval
All Cases (n=338)	54.92%	50.14% - 59.71%
Type I Habitat (n=135)	37.21%	29.36% - 45.07%
Type II & III Habitat (n=62)	79.78%	72.81% - 86.75%
Wetlands (n=141)	68.09%	61.73% - 74.44%

*Differences between strata are significant (p<.001).

Table 3-2. Success rates for sites where mitigation was installed as prescribed vs. sites where it was not installed as prescribed (population estimates for All Cases)

	Mitigation installed as prescribed	Mitigation not installed as prescribed
All Cases (n=338)*	65.41% (211)	8.74% (127)

*Differences are significant (p<.001).

Table 3-3. Success rates for sites where mitigation was installed as prescribed vs. sites where it was not installed as prescribed by strata (population estimates for All Cases)

Strata*	Mitigation installed as prescribed	Mitigation not installed as prescribed
Type I Habitat (n=135)	63.98%	4.05%
Type II & III Habitat (n=62)	48.96%	0%
Wetlands (n=141)	70.83%	20%

*Differences are significant for each strata (p<.001).

Table 3-4. Was the site of the mitigation appropriate? (Population estimates for All Cases)

Strata*	Estimate	95% confidence interval
All Cases (n=335)	95.62%	93.88% - 97.36%
Type I Habitat (n=134)	96.05%	93.38% - 98.72%
Type II & III Habitat (n=62)	90.44%	85.37% - 95.51%
Wetlands (n=139)	96.40%	93.84% - 98.97%

*Differences between strata are marginally significant (p=.11) – mostly Type II & III Habitat have a somewhat lower likelihood that the mitigation site was appropriate.

Table 3-5. Percent cases where site was appropriate when mitigation was installed as prescribed vs. when it was not installed as prescribed (population estimates)

	Mitigation installed as prescribed	Mitigation not installed as prescribed
Percent cases where site was appropriate(n=332)*	95.30% (210)	95.92% (122)

*Differences are not statistically significant (p=.74).

Table 3-6 Percent cases where the mitigation was not installed as proscribed, but the planted site more appropriate?

For this question, there are only 20 sites where the mitigation site was not appropriate, and of these, six have missing answers on the question "was the planted site more appropriate", leaving n=14. Of these 14 sites, in five cases (36%), the planted site was more appropriate.

Conclusions:

- Mitigation installed as approved in more than 2/3 of the cases for all Type II and III permits.
- Mitigation for habitat permits are almost always unsuccessful when not installed in the approved location, but mitigation for wetland permits occasionally succeed in these circumstances.
- Mitigation is more likely to succeed if installed in the approved location, particularly for Type I Habitat Permits.
- The approved mitigation for both wetland and habitat permits sites are almost always appropriate for the prescribed mitigation.
- Mitigation sites are rarely relocated without prior approval, but when they are they are not likely to be located in more appropriate sites.

Chapter 5 Maintenance Adequacy

Chapter 5.A Invasive Species Coverage

Questions:

1. What is the distribution of invasive species coverage observed?
2. How does invasive species coverage affect mitigation success?

Results:

Table 5.A-1. How much of the area is covered with invasive species? (Population estimates)*

Coverage Class	All Cases (n=333)	Type I Habitat (n=131)	Type II & III Habitat (n=60)	Wetlands (n=142)
0-5%	29.45%	36.84%	26.25%	22.54%
5-25%	22.29%	19.98%	22.45%	24.65%
25-50%	17.12%	16.31%	25.00%	16.20%
50-75%	13.28%	14.05%	6.19%	14.08%
75-95%	14.40%	11.75%	18.56%	16.20%
95-100%	3.46%	1.08%	1.55%	6.34%

*Differences between strata are significant (p<.01).

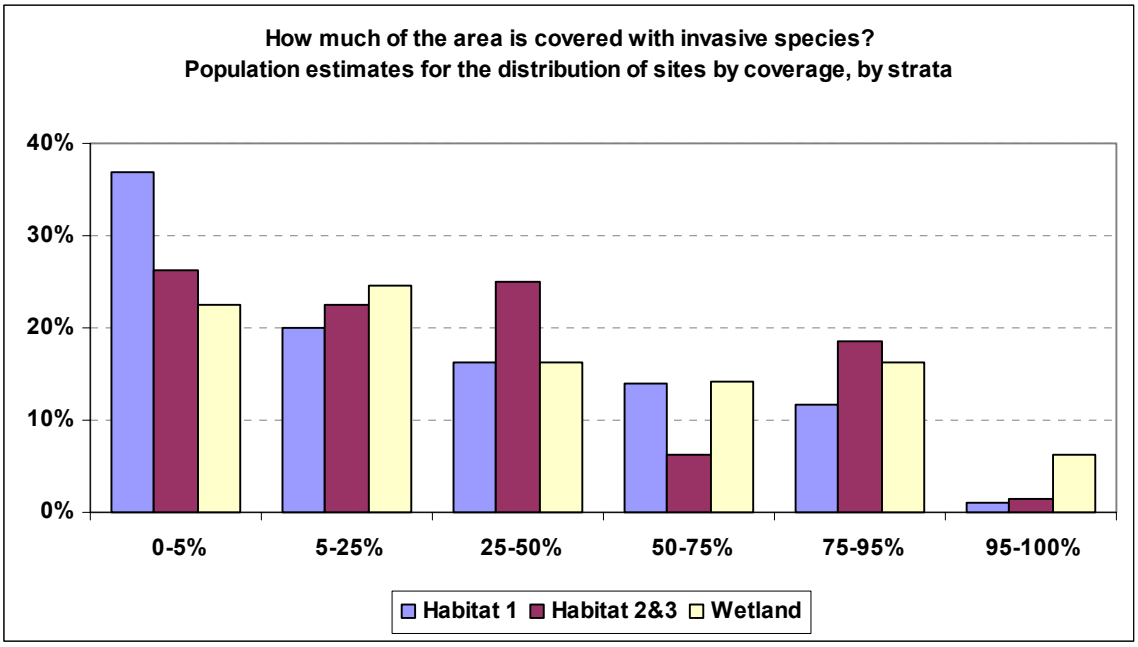

Figure 5.A-1. Site area covered by Invasive Species by strata (population estimates)

Table 4A-2. Area coverage by invasive species and success rates

Coverage Class	All Cases (n=333)	Type I Habitat (n=131)	Type II & III Habitat (n=60)	Wetlands (n=142)

0-5%	46.08%	35.09%	54.30%	62.50%
5-25%	47.52%	34.12%	41.34%	60.00%
25-50%	40.18%	20.48%	39.63%	60.87%
50-75%	27.48%	20.42%	25.00%	35.00%
75-95%	28.85%	2.01%	33.33%	47.83%
95-100%	18.05%	0%	0%	22.22%
p-values	p<.05	p=.05	not significant	p<.05

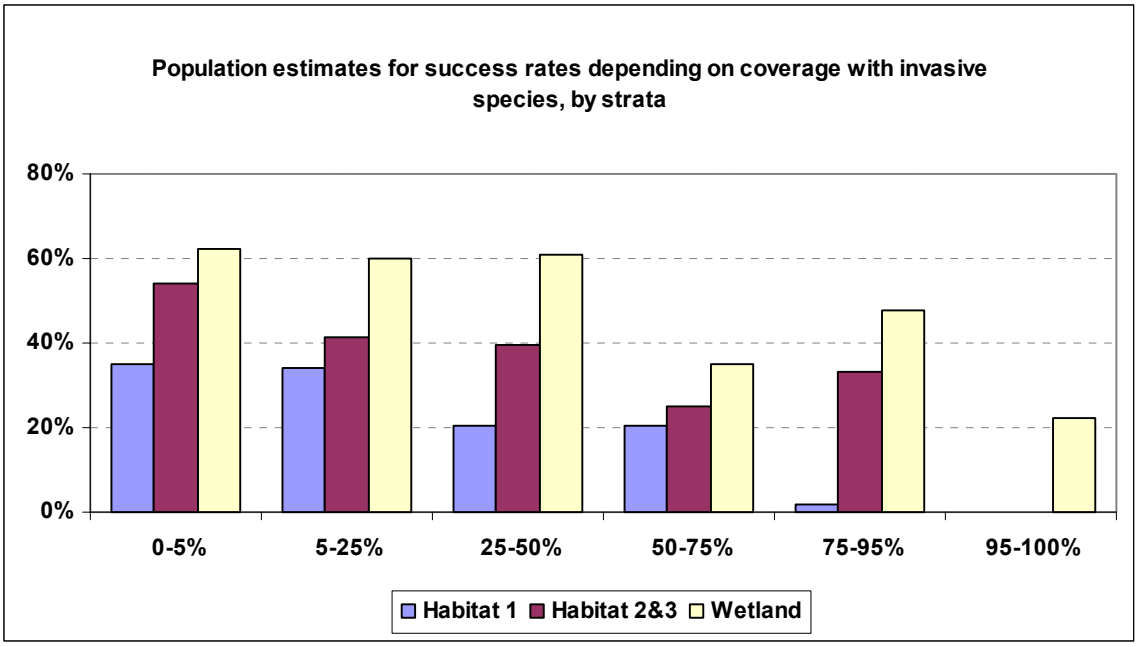

Figure 5.A-2. Success rates by Invasive Species coverage by strata (population estimates)

Conclusions

- Most mitigation sites have moderate to low invasive species coverage
- In general, low to moderate invasive species coverage correlates with higher mitigation success rates
- Higher coverage of invasive species slightly reduces the likelihood that wetland mitigation will succeed.

Chapter 5.A.2 Related Analyses

- A comparison of invasive species coverage with the level of threat of invasive species from adjacent sites can be found in Chapter 5.B.2-1.
- A comparison of the coverage of invasive species with the frequency that mitigation plantings were out-competed by non-native vegetation can be found in Chapter 6.A.2-1.

Chapter 5.B Threats From Invasive Species

Questions:

1. What is level of threat to the mitigation site from invasive species in adjacent areas?
2. How does the level of threat from invasive species in adjacent areas affect mitigation success?

Results:

Table 5.B-1 Level of threat from invasive species in adjacent areas (Population estimates for All Cases)*

Threat Level	Estimate	95% confidence interval
All Cases (n=334)		
Low	42.95%	38.11% - 47.91%
Medium	21.65%	17.95% - 25.88%
High	35.40%	30.89% - 40.20%
Type I Habitat (n=131)		
Low	53.14%	44.54% - 61.56%
Medium	18.57%	12.78% - 26.18%
High	28.29%	21.21% - 36.64%
Type II & III Habitat (n=60)		
Low	28.60%	21.41% - 37.05%
Medium	38.92%	31.31% - 47.11%
High	32.48%	25.49% - 40.36%
Wetlands (n=143)		
Low	35.66%	29.49% - 42.35%
Medium	20.98%	16.01% - 26.99%
High	43.36%	36.83% - 50.12%

*Differences between strata are significant ($p<.001$).

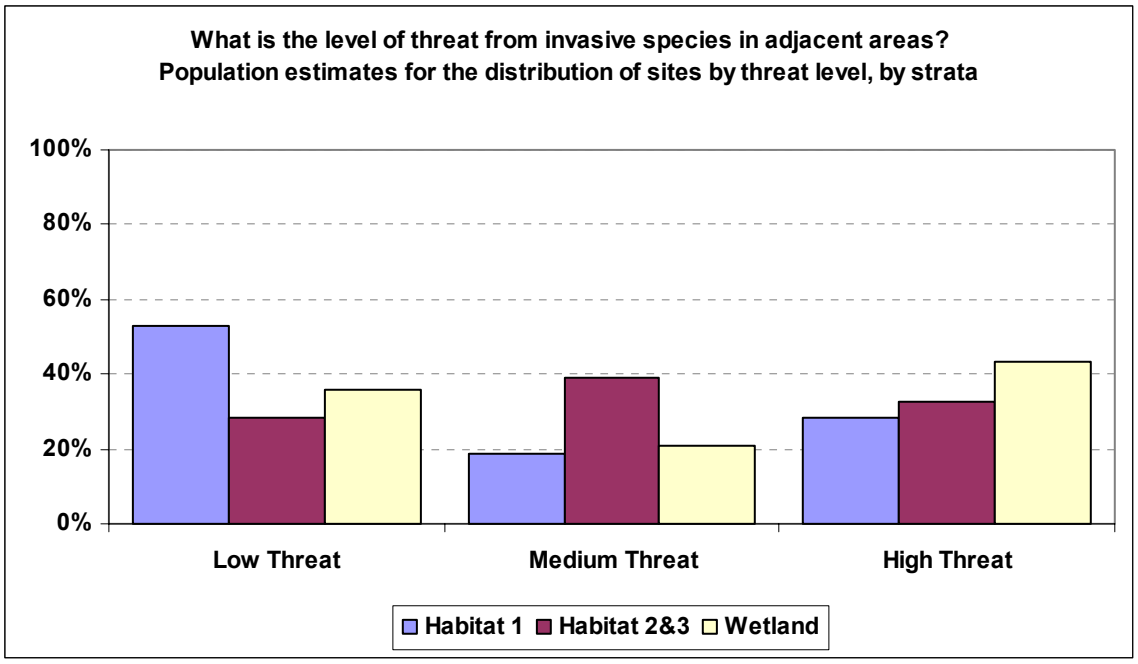

Figure 5.B-1. threat level of Invasive species from adjacent area by strata (population estimates)

Table 5.B-2. Mitigation success rates and threat from invasive species in adjacent areas (Population estimates for All Cases)

Strata**	Low threat*	Medium threat*	High threat*
All Cases (n=334)	42.29%	42.60%	33.79%
Type I Habitat (n=131)	33.79%	27.62%	10.97%
Type II & III Habitat (n=60)	44.44%	33.40%	47.62%
Wetlands (n=143)	54.90%	60.00%	46.77%

*Differences between low & medium vs. high are marginally significant (p=.08).
**By strata, differences are significant for Type I Habitat only (p<.05).

Conclusions

- The threat of invasive species adjacent to the mitigation site is generally lower for type I habitat cases.
- Mitigation success rates are better for type I habitat cases when the threat of invasive species adjacent to the mitigation site is lower.
- The threat of invasive species adjacent to the mitigation site does not affect mitigation success for type II and III habitat cases and wetland cases.

Chapter 5.B.2 Related Analyses

- For a comparison of the threat of invasive species adjacent to the mitigation site with the frequency that mitigation plantings were out-competed by non-native vegetation see Chapter 6.A.2-2.

5.B.2-1 Comparison of the threat of invasive species adjacent to the mitigation site with invasive species coverage on the site.

Questions:

1. Does the threat of invasive species adjacent to the mitigation site affect invasive species coverage on the site?

Results:

Table 5.B-3. The level of threat from invasive species in adjacent areas versus area coverage by invasive species (case counts)

Coverage Class	Low threat	Medium Threat	High Threat
All Cases			
0-5%	73	11	6
5-25%	37	29	13
25-50%	9	30	23
50-75%	4	11	27
75-95%	3	3	43
95-100%	2	-	9
Type I Habitat			
0-5%	40	-	3
5-25%	20	9	2
25-50%	2	16	6
50-75%	-	5	13
75-95%	-	-	14
95-100%	-	-	1
Type II & III Habitat			
0-5%	11	4	-
5-25%	2	9	2
25-50%	1	8	6
50-75%	-	2	2
75-95%	1	1	10
95-100%	-	-	1
Wetlands			
0-5%	22	7	3
5-25%	15	11	9
25-50%	6	6	11
50-75%	4	4	12
75-95%	2	2	19
95-100%	2	-	7

Conclusions

- Invasive species coverage on the mitigation site generally rises with the threat level of invasive species from adjacent sites.

Chapter 6 Mitigation Success

Chapter 6.A Competition from non-native species

Questions:

1. Have the plantings been out-competed by non-natives?
2. How does competition by non-natives affect mitigation success?

Results:

Table 6.A-1. Have the plantings been out-competed by non-natives (actual sample data)

Status	Habitat I	Habitat II & III	Wetland	Total
Yes	13	13	30	56
No	69	43	93	205
Total	82	56	123	261

Table 6.A-2. Population Estimate for the proportion of sites where plantings were out-competed by non-natives

Strata	Percent out-competed by non-natives	95% confidence interval
All Cases (n=261)	21.21%	16.59% - 25.83%
Type I Habitat (n=82)	14.85%	6.22% - 23.49%
Type II & III Habitat (n=56)	23.56%	15.94% - 31.19%
Wetlands (n=123)	24.39%	17.91% - 30.87%

Table 6.A-3. Population Estimate for mitigation success rates where plantings were out-competed by non-natives versus NOT out-competed by non-natives

Strata	Out-competed	Not out-competed	Significant differences?
All Cases (n=261)	24.45%	62.36%	p<.001
Habitat Type I (n=82)	24.53%	58.39%	p<.05
Type II & III Habitat (n=56)	14.54%	55.18%	p<.001
Wetlands (n=123)	26.67%	66.67%	p<.001

Conclusions

- Plantings are out-competed by non-native vegetation about 15 % of the time for Type I habitat permits and 25% of the time for all other cases.
- Sites where plantings are out-competed by non-natives are more likely to fail for Type II and III habitat permits and wetland permits.
- Sites where plantings are not out-competed are more likely to succeed.

Chapter 6.A.2 Related Analyses

Chapter 6.A.2-1 Comparison of the coverage of invasive species with the frequency that mitigation plantings were out-competed by non-native vegetation.

Question:

1. How does the likelihood that mitigation plantings will be out-competed by non-native vegetation change with coverage of invasive species.

Results:

Table 6.A-4 Area coverage with invasive species versus plantings out-competed by non-natives (actual sample distribution)

Coverage Class	Plantings out-competed by non-natives	Plantings NOT out-competed by non-natives
All Cases		
0-5%	-	72
5-25%	3	56
25-50%	18	36
50-75%	15	17
75-95%	15	19
95-100%	5	3
Type I Habitat		
0-5%	-	30
5-25%	1	19
25-50%	5	12
50-75%	6	6
75-95%	1	1
95-100%	-	-
Type II & III Habitat		
0-5%	-	14
5-25%	2	9
25-50%	6	9
50-75%	1	2
75-95%	4	8
95-100%	-	1
Wetlands		
0-5%	-	28
5-25%	-	28
25-50%	7	15
50-75%	8	9
75-95%	10	10
95-100%	5	2

Table 6.A-5 Population estimates for the percent of sites where plantings were out-competed by non-natives, by invasive species area coverage (p<.001 for All Cases, and all strata)

Coverage Class	Estimate	95% confidence interval
All Cases (n=259)		
0-5%	0%	N/A
5-25%	2.86%	1.25% - 6.42%
25-50%	30.20%	19.98% - 42.85%
50-75%	51.79%	35.70% - 67.52%
75-95%	48.69%	34.30% - 63.30%
95-100%	66.73%	36.95% - 87.29%
Type I Habitat (n=81)		
0-5%	0%	N/A
5-25%	2.64%	0.41% - 15.15%
25-50%	21.11%	6.83% - 49.39%
50-75%	63.61%	32.22% - 86.54%
75-95%	82.09%	26.22% - 98.34%
95-100%	14.92%	8.13% - 25.81%
Type II & III Habitat (n=56)		
0-5%	0%	N/A
5-25%	18.18%	7.37% - 38.31%
25-50%	41.81%	26.14% - 59.32%
50-75%	33.33%	9.08% - 71.44%
75-95%	33.33%	18.27% - 52.80%
95-100%	0%	N/A
Wetlands (n=122)		
0-5%	0%	N/A
5-25%	0%	N/A
25-50%	31.82%	17.81% - 50.13%
50-75%	47.06%	28.25% - 66.74%
75-95%	50.00%	32.09% - 67.91%
95-100%	71.43%	38.08% - 91.04%

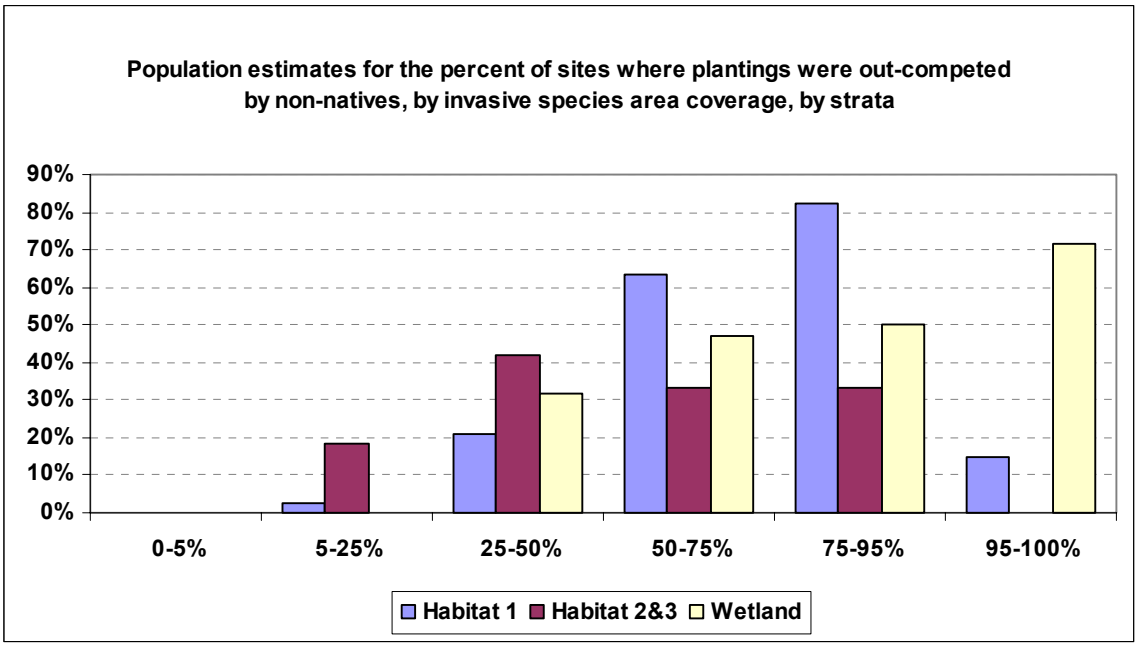

Figure 6.A-1. Percent of sites where non-natives out-competed plantings by invasive species area coverage (population estimates)

Conclusions

- For wetland permits and Type I habitat permits plantings are more likely to be out-completed by non-natives as invasive species coverage increases.
- For Type II and III habitat permits there is no significant relationship between invasive species coverage and competition with non-native vegetation.

Chapter 6.A.2-2 Comparison of the threat of invasive species adjacent to the mitigation site with the frequency that mitigation plantings were out-competed by non-native vegetation.

Questions:

1. Does the likelihood that non-native species will out-complete mitigation plantings change with the level of threat from invasive species n adjacent sites?

Results:

Table 6.A-6. Level of threat from invasive species in adjacent areas versus plantings out-competed by non-natives (actual sample distribution).

Threat Level	Plantings out-competed by non-natives	Plantings NOT out-competed by non-natives
All Cases		
Low	3	90
Medium	19	54
High	34	60
Type I Habitat		
Low	-	38
Medium	5	17
High	8	13
Type II & III Habitat		
Low	1	11
Medium	8	15
High	4	17
Wetlands		
Low	2	41
Medium	6	22
High	22	30

Table 6.A-7 Population estimates for the percent of sites where Plantings were out-competed by non-natives, by threat level; p<.01 for All Cases, and all strata

Threat level	Estimate	95% confidence interval
All Cases (n=260)		
Low	2.75%	1.04% - 7.09%
Medium	21.62%	14.59% - 30.82%
High	42.75%	33.72% - 52.29%
Type I Habitat (n=81)		
Low	0%	N/A
Medium	10.95%	4.22% - 25.26 %
High	60.98%	37.48% - 80.30%
Type II & III Habitat (n=56)		
Low	7.57%	2.02% - 24.51%
Medium	36.24%	24.03% - 50.53%

High	19.05%	10.18% - 32.82%
Wetlands (n=123)		
Low	4.65%	1.43% - 14.08%
Medium	21.43%	11.21% - 37.08%
High	42.31%	31.44% - 53.98%

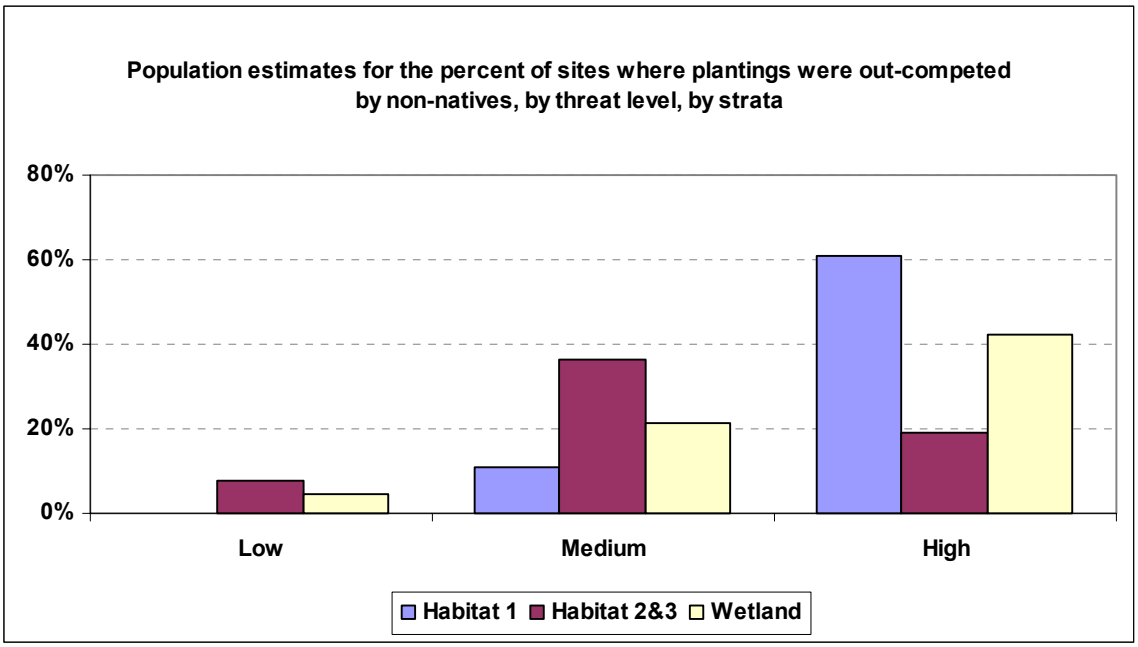

Table 6.A-2. Percent of sites where non-natives out-competed plantings by threat level and strata (population estimates)

Conclusions

- Plantings are more likely to be out-competed by non-natives at higher threat levels.
- Low threat of invasive species increases the likelihood that plantings will not be out-competed by non-natives.

Chapter 6.B Competition with Local Natives Species

Questions:

1. Have the plantings been out-competed by local natives?
2. How does competition by local natives affect mitigation success?

Results:

Table 6.B-1. Have the plantings been out-competed by local natives (actual sample data)

Status	Habitat I	Habitat II & III	Wetland	Total
Yes	8	14	30	52
No	69	40	92	201
Total	77	54	122	253

Table 6.B-2. Population estimate for the proportion of sites where plantings were out-competed by local natives

Strata	Percent out-competed by local natives	95% confidence interval
All Cases (n=253)	19.71%	15.29% - 24.13%
Type I Habitat (n=77)	9.23%	2.11% - 16.34%
Type II & III Habitat (n=54)	24.83%	16.98% - 32.69%
Wetlands (n=122)	24.59%	18.06% - 31.12%

Table 6.B-3. Population estimate for mitigation success rates where plantings were out-competed by local natives versus not out-competed by local natives

Strata	Out-competed	Not out-competed	Significant differences?
All Cases (n=253)	45.38%	56.70%	p=.12
Type I Habitat (n=77)	64.89% (n=8)	52.55%	p=.56
Type II & III Habitat (n=54)	21.43%	51.02%	p<.01
Wetlands (n=122)	46.67%	60.87%	p=.11

Conclusions

- Plantings are out-competed by local native vegetation about 10 % of the time for Type I habitat permits and 25% of the time for all other cases.
- Sites where plantings are out-competed by non-natives are more likely to fail for Type II and III habitat permits.
- Competition with local natives does not significantly affect success.

Chapter 6.B.2 Related Analyses

Chapter 6.B.2-1 Competition by Non-natives and Local Natives Combined

Questions:

1. How do competition results compare when non-native and local native vegetation are looked at together
2. How does All Cases competition affect mitigation success?

Results:

Table 6.B-4. Population estimates for the proportion of sites that have been out-competed by non-natives, locals, both or none

Status	Percent	95% confidence interval
All Cases (n=243)		
Not out-competed (n=176)	69.74%	64.19% - 74.77%
Out-competed by non-natives only (n=25)	10.55%	7.40% - 14.83%
Out-competed by locals only (n=26)	9.77%	6.90% - 13.67%
Out-competed by both (n=26)	9.94%	7.14% - 13.68%
Total	100%	
Type I Habitat (n=77)		
Not out-competed (n=62)	80.27%	68.18% - 88.54%
Out-competed by non-natives only (n=7)	10.50%	4.80% - 21.45%
Out-competed by locals only (n=6)	6.48%	2.54% - 15.56%
Out-competed by both (n=2)	2.75%	0.59% - 11.79%
Total	100%	
Type II & III Habitat (n=54)		
Not out-competed (n=35)	64.96%	55.66% - 73.24%
Out-competed by non-natives only (n=5)	10.21%	5.59% - 17.93%
Out-competed by locals only (n=6)	10.64%	6.22% - 17.61%
Out-competed by both (n=8)	14.19%	8.97% - 21.72%
Total	100%	
Wetlands (n=122)		
Not out-competed (n=79)	64.75%	57.21% - 71.62%
Out-competed by non-natives only (n=13)	10.66%	6.80% - 16.32%
Out-competed by locals only (n=14)	11.48%	7.45% - 17.26%
Out-competed by both (n=16)	13.11%	8.78% - 19.13%
Total	100%	

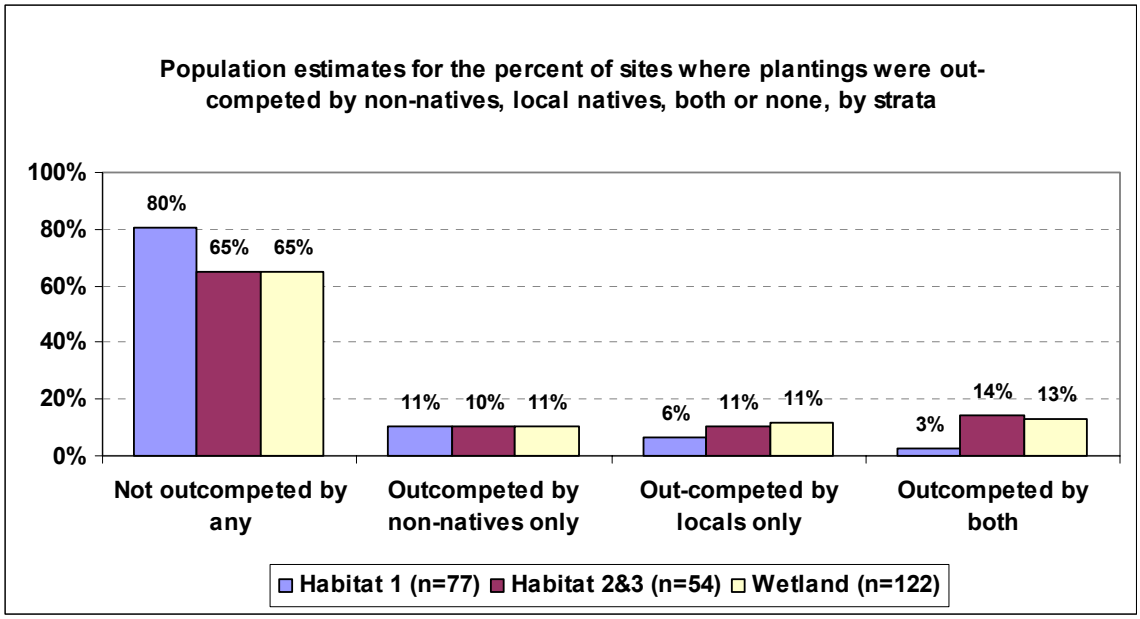

Table 6.B-1. Population estimates for the proportion of sites that have been out-competed by non-natives, locals, both or none

Table 6.B-5. Population estimates for the mitigation success rates of sites that have been out-competed by non-natives, locals, both or none (p<.001)

Status	Success rate	Significant differences?
Not out-competed (n=176)	62.72%	yes: p<.001
Out-competed by non-natives only (n=25)	16.94%	
Out-competed by locals only (n=26)	59.05%	
Out-competed by both (n=26)	31.94%	

Conclusions

- A majority of cases do not have competition problems.
- For strata with a higher rate of competition with non-native species, there is a higher rate of simultaneous competition with local natives.
- Sites where plantings are out-competed by non-natives are more likely to fail.
- Competition with local natives does not significantly affect success.

Chapter 6.C Planting Height

Questions:

1. What proportion of mitigation sites where trees or shrubs have been planted?
2. How does the presence of trees and shrubs affect mitigation success?
3. What is the distribution of the height of trees or shrubs in mitigation sites?
4. Do success rates vary with observed tree or shrub height?

Results:

Table 6.C-1. Population estimates for the percent of sites that have mitigation plantings at all (indifferent of height)

	Estimate	95% confidence interval
Trees	58.07%	53.44% - 62.70%
Shrubs	41.34%	37.60% - 45.09%

Table 6.C-2. Population estimates for the percent of sites that have mitigation plantings at all (indifferent of height) for Trees

Strata	Estimate	Significant differences?
Type I Habitat	35.67%	
Type II & III Habitat	78.31%	Yes: p<.001
Wetlands	76.71%	

Table 6.C-3. Population estimates for the percent of sites that have mitigation plantings at all (indifferent of height) for shrubs

Strata	Estimate	Significant differences?
Type I Habitat	8.87%	
Type II & III Habitat	70.22%	Yes: p<.001
Wetlands	68.49%	

Table 6.C-4. Population estimates for success rates for sites that have mitigation plantings versus those that do not (indifferent of height)

Strata	Success rate if plantings are present	Success rate if no plantings are present	Significant differences?
Trees			
All Cases	61.42%	9.29%	Yes: p<.001
Type I Habitat	70.30%	1.98%	Yes: p<.001
Type II & III Habitat	46.13%	13.53%	Yes: p<.001
Wetlands	60.71%	29.41%	Yes: p<.001
Shrubs			
All Cases	62.38%	23.48%	Yes: p<.001
Type I Habitat	61.03%	22.98%	Yes: p<.001
Type II & III Habitat	47.77%	18.51%	Yes: p<.01
Wetlands	66.00%	26.09%	Yes: p<.001

Table 6.C-5. Actual data distribution for sites with mitigation Plantings

Strata	0-5 ft	5-10 ft	10-15ft	15+ ft	Total
Trees (n=230)					
All Cases	64	76	51	39	230
Type I Habitat	27	23	16	1	67
Type II & III Habitat	22	15	10	4	51
Wetlands	15	38	25	34	112
Shrubs (n=168)					
All Cases	93	61	13	1	168
Type I Habitat	11	9	1	0	21
Type II & III Habitat	33	11	3	0	47
Wetlands	49	41	9	1	100

Table 6.C-6. Population estimates for the distribution of the height of the mitigation plantings for Trees

Height Class	Percent	95% confidence interval
ALL CASES (n=230)		
0-5 ft	23.55%	18.89% - 28.94%
5-10 ft	35.19%	29.42% - 41.43%
10-15 ft	22.39%	17.60% - 28.05%
15+ ft	18.87%	14.81% - 23.72%
Total	100%	
Type I Habitat (n=67)		
0-5 ft	35.55%	23.62% - 49.60%
5-10 ft	39.86%	27.02% - 54.27%
10-15 ft	23.95%	13.99% - 37.87%
15+ ft	0.64%	0% < - 4.02%
Total	100%	
Type II & III Habitat (n=51)		
0-5 ft	42.08%	32.72% - 52.04%
5-10 ft	30.94%	22.41% - 40.99%
10-15 ft	19.49%	12.84% - 28.47%
15+ ft	7.49%	3.76% - 14.37%
Total	100%	
Wetlands (n=112)		
0-5 ft	13.39%	8.79% - 19.89%
5-10 ft	33.93%	26.76% - 41.92%
10-15 ft	22.32%	16.33% - 29.74%
15+ ft	30.36%	23.49% - 38.23%
Total	100%	

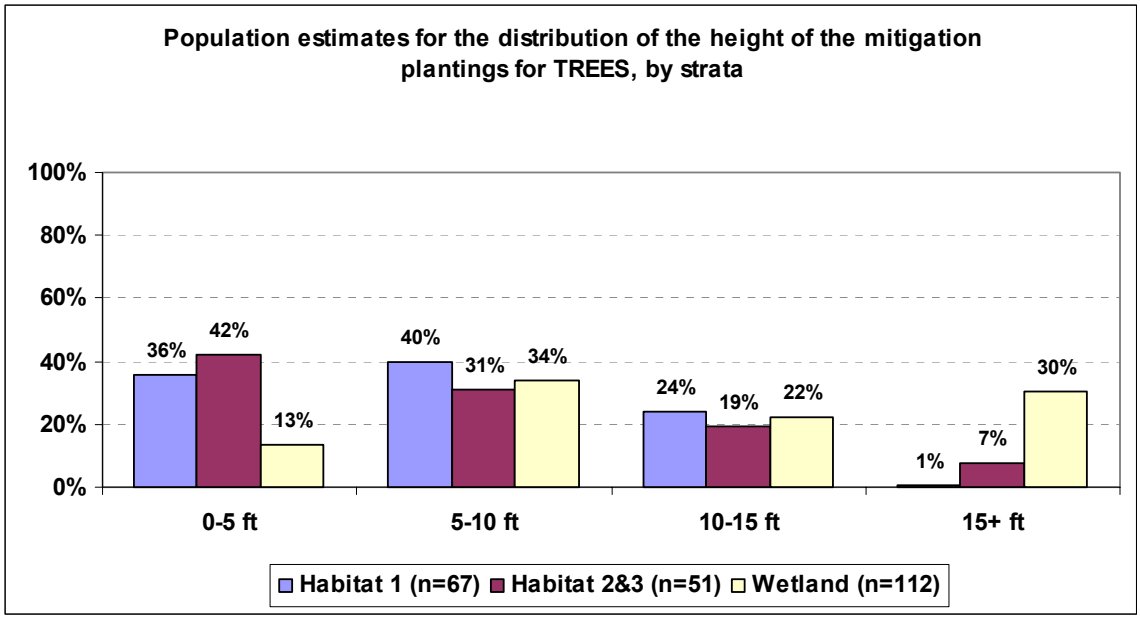

Figure 5C-1. Population estimates for the distribution of the height of mitigation plantings for Trees by strata

Table 6.C-7. Population estimates for success rates given the height of the mitigation plantings for Trees

Height Class	Success rate	Significant differences?
ALL CASES (n=230)		
0-5 ft	35.40%	Yes: p<.001
5-10 ft	58.66%	
10-15 ft	83.79%	
15+ ft	72.51%	
Type I Habitat (n=67)		
0-5 ft	40.12%	Yes: p<.01
5-10 ft	78.91%	
10-15 ft	100.00%	
15+ ft	100.00% (n=1)	
Type II & III Habitat (n=51)		
0-5 ft	20.94%	Yes: p<.001
5-10 ft	57.61%	
10-15 ft	80.78%	
15+ ft	50.00% (n=4)	
Wetlands (n=112)		
0-5 ft	40.00%	Yes: p<.01
5-10 ft	47.37%	
10-15 ft	76.00%	
15+ ft	73.53%	

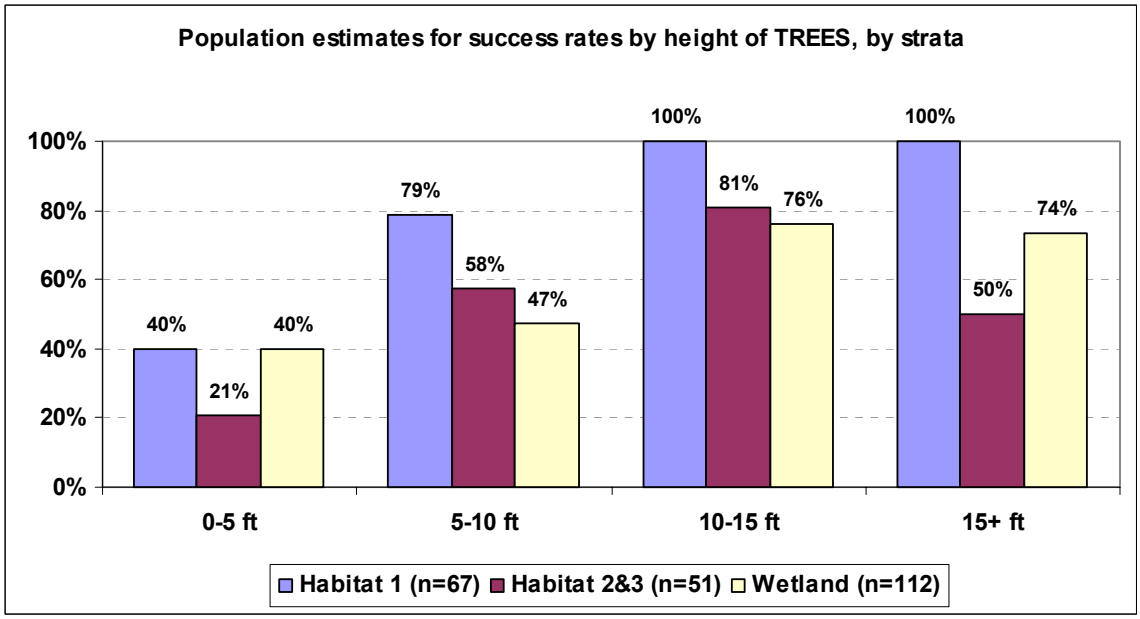

Table 6.C-2. Population estimates for success rates by height of the mitigation plantings for Trees (by strata)

Table 6.C-8. Population estimates for the distribution of the height of the mitigation plantings for Shrubs

Height Class	Percent	95% confidence interval
ALL CASES (n=168)		
0-5 ft	53.27%	46.17% - 60.24%
5-10 ft	37.20%	30.63% - 44.27%
10-15 ft	8.80%	5.36% - 14.14%
15+ ft	0.73%	0.13% - 4.01%
Total	100%	
Type I Habitat (n=21)		
0-5 ft	55.89%	28.03% - 80.48%
5-10 ft	32.33%	12.89% - 60.68%
10-15 ft	11.78%	1.50% - 53.96%
15+ ft	0%	N/A
Total	100%	
Type II & III Habitat (n=47)		
0-5 ft	69.90%	59.24% - 78.78%
5-10 ft	23.83%	15.86% - 34.18%
10-15 ft	6.27%	2.72% - 13.79%
15+ ft	0%	N/A
Total	100%	
Wetlands (n=100)		
0-5 ft	49.00%	40.41% - 57.65%
5-10 ft	41.00%	32.78% - 49.76%
10-15 ft	9.00%	5.11% - 15.38%

Height Class	Percent	95% confidence interval
15+ ft	1.00%	0.18% - 5.50%
Total	100%	

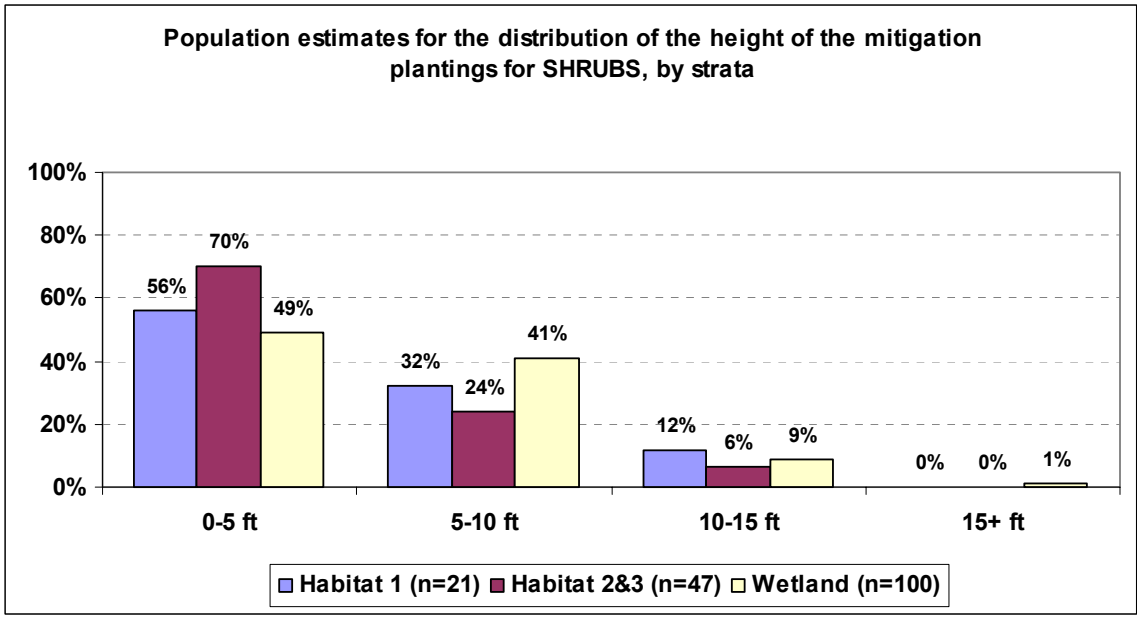

Table 6.C-3. Population estimates for the distribution of the height of the mitigation plantings for Shrubs by strata

Table 6.C-9. Population estimates for success rates given the height of the mitigation plantings for Shrubs

Height Class	Success rate	Significant differences?
ALL CASES (n=168)		
0-5 ft	51.36%	Yes: p<.01
5-10 ft	73.40%	
10-15 ft	79.34%	
15+ ft	100% (n=1)	
Type I Habitat (n=21)		
0-5 ft	51.34%	No: p=.58 (small n)
5-10 ft	63.57%	
10-15 ft	100.00%	
15+ ft	N/A	
Type II & III Habitat (n=47)		
0-5 ft	40.23%	No: p=.10 (marginally significant)
5-10 ft	64.93%	
10-15 ft	66.67%	
15+ ft	N/A	
Wetlands (n=100)		
0-5 ft	55.10%	No: p=.08 (marginally significant)
5-10 ft	75.61%	

Height Class	Success rate	Significant differences?
10-15 ft	77.78%	
15+ ft	100% (n=1)	

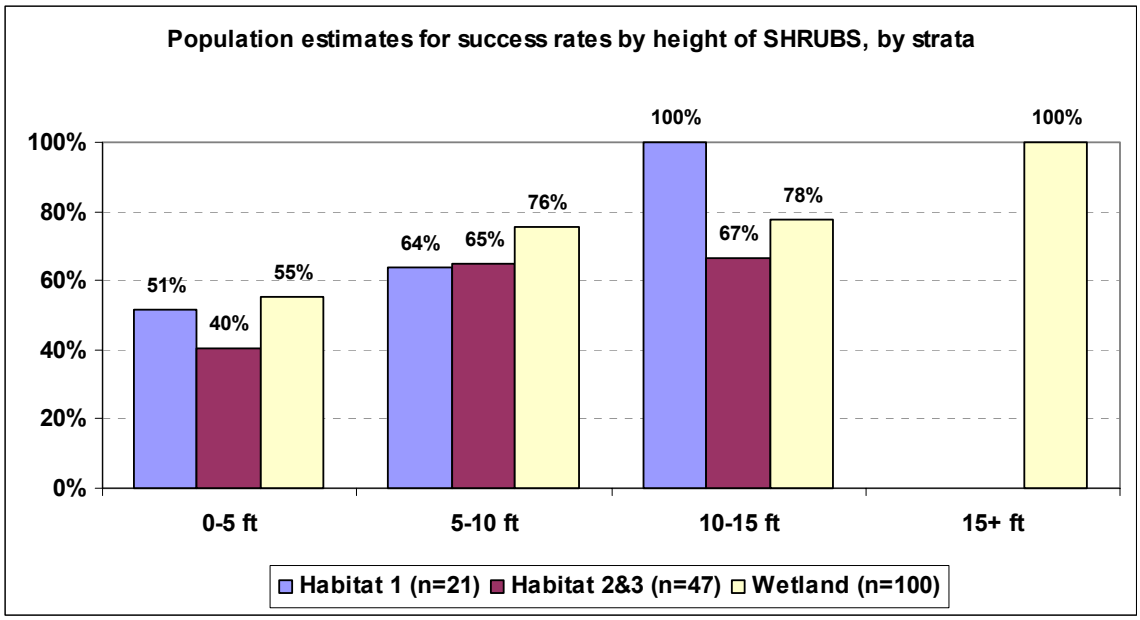

Table 6.C-4. Population estimates for success rates given the height of the mitigation plantings for Shrubs (by strata)

Conclusions

- Planting is much less likely to occur for Type I habitat permits.
- Less than 10% of Type I habitat permits have observed shrub plantings.
- There are other significant differences between trees and shrubs.
- Plantings are generally less mature for habitat permits vs. wetland permits.
- Taller trees and shrubs increase the likelihood of success.

Chapter 6.D Canopy Structure

Questions:

1. What is the composition of each canopy layer (dominance of native vs. non-native)?
2. How does composition affect mitigation success?
3. What proportion of mitigation sites where trees or shrubs have been planted?
4. Are the canopy layers dominated by native or non-native species?

Results:

Table 6.D-1. Canopy layers present on the site (actual sample data)

Strata	Layer Present	Layer not Present
Trees		
Type I Habitat	74	61
Type II & III Habitat	55	7
Wetlands	135	11
Total	264	79
Shrubs		
Type I Habitat	46	89
Type II & III Habitat	52	10
Wetlands	137	9
Total	235	108
Herbs		
Type I Habitat	44	91
Type II & III Habitat	52	10
Wetlands	139	7
Total	235	108

Table 6.D-2. Population Estimates for the percent of sites where each canopy layer is present

Strata*	Estimate	95% confidence interval
Trees		
All Cases	66.71%	62.29% - 71.13%
Type I Habitat	38.09%	30.27% - 45.89%
Type II & III Habitat	84.18%	77.56% - 90.80%
Wetlands	92.47%	88.96% - 95.97%
Shrubs		
All Cases	56.61%	52.92% - 60.30%
Type I Habitat	16.19%	11.17% - 21.22%
Type II & III Habitat	77.56%	70.12% - 85.00%
wetlands	93.84%	90.64% - 97.03%
Herbs		
All Cases	56.63%	53.04% - 60.22%

Type I Habitat	14.92%	10.17% - 19.67%
Type II & III Habitat	77.56%	70.12% - 85.00%
Wetlands	95.21%	92.37% - 98.04%

*Differences between strata are significant, p<.001.

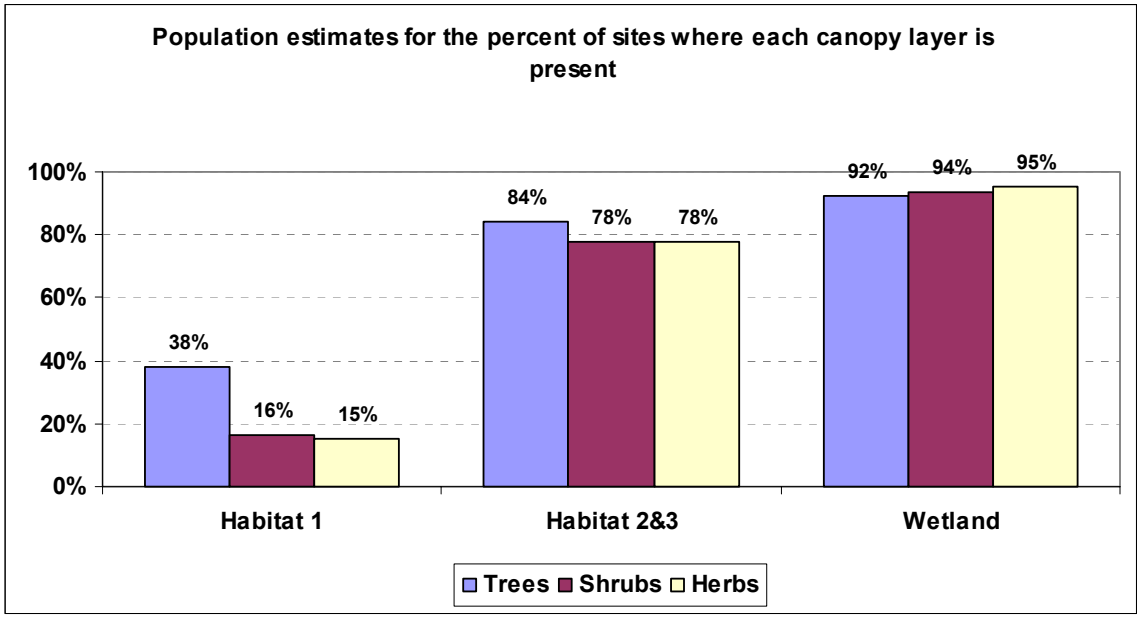

Table 6.D-1. Population Estimates for the percent of sites where each canopy layer is present

Table 6.D-3. Population estimates for success rates depending upon the presence or absence of each canopy layer

Strata	Success rate if layer is present on site	Success rate if layer is absent	Significant differences?
Trees			
All Cases	56.83%	4.98%	Yes: p<.001
Type I Habitat	69.19%	0%	Yes: p<.001
Type II & III Habitat	44.65%	9.27%	Yes: p<.001
Wetlands	54.07%	45.45%	No: p=.50
Shrubs			
All Cases	52.77%	22.33%	Yes: p<.001
Type I Habitat	53.93%	21.02%	Yes: p<.001
Type II & III Habitat	45.14%	18.02%	Yes: p=.01
Wetlands	54.01%	44.44%	No: p=.49
Herbs			
All Cases	53.10%	21.89%	Yes: p<.001
Type I Habitat	57.00%	20.98%	Yes: p<.001
Type II & III Habitat	45.14%	18.02%	Yes: p=.01
Wetlands	53.96%	42.86%	No: p=.48

Table 6.D-4 Dominance of native vs. non-native vegetation by canopy layer (actual sample data).

Strata	Native	Not native
Trees		
Type I Habitat	59	7
Type II & III Habitat	35	16
Wetlands	91	27
Total	185	50
Shrubs		
Type I Habitat	25	7
Type II & III Habitat	36	13
Wetlands	90	26
Total	151	46
Herbs		
Type I Habitat	26	2
Type II & III Habitat	34	16
Wetlands	86	35
Total	146	53

Table 6.D-5. Population estimates for the percent of canopy layers present on site that are native

Strata	Estimate	95% confidence interval
Trees*		
All Cases (n=235)	81.29%	77.07% - 85.51%
Type I Habitat (n=66)	95.60%	92.41% - 98.80%
Type II & III Habitat (n=51)	70.03%	61.11% - 78.94%
Wetlands (n=118)	77.12%	70.59% - 83.65%
Shrubs**		
All Cases (n=197)	77.50%	72.19% - 82.81%
Type I Habitat (n=32)	81.46%	64.73% - 98.19%
Type II & III Habitat (n=49)	73.93%	64.99% - 82.87%
Wetlands (n=116)	77.59%	71.03% - 84.15%
Herbs***		
All Cases (n=199)	72.10%	66.46% - 77.73%
Type I Habitat (n=28)	87.84%	68.87% - >100%
Type II & III Habitat (n=50)	67.06%	57.48% - 76.63%
Wetlands (n=121)	71.07%	64.15% - 77.80%

*Differences between strata are significant, p<.001.
**Differences between strata are not significant, p=.70
***Differences between strata are not significant, p=.23.

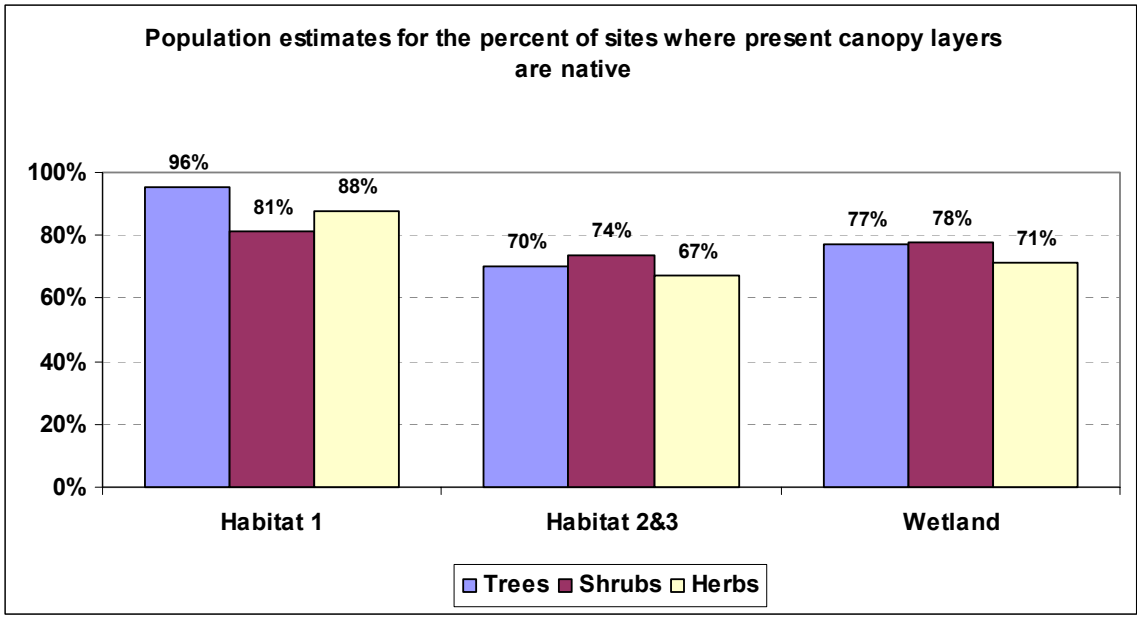

Figure 6.D-2. Population estimates for the percent of canopy layers present on site that are native

Table 6.D-6. Population estimates for the success rates for sites where canopy layers are native versus non-native

Strata	Success rate if trees are native	Success rate if layer is not native	Significant differences?
Trees			
All Cases (n=235)	63.23%	16.00%	Yes: p<.001
Types I Habitat (n=66)	72.73%	0%	Yes: p<.001
Type II & III Habitat (n=51)	49.82%	25.00%	Yes: p<.05
Wetlands (n=118)	60.44%	14.81%	Yes: p<.001
Shrubs			
All Cases (n=197)	56.63%	20.95%	Yes: p<.001
Type I Habitat (n=32)	53.23%	43.31%	No: p=.74
Type II & III Habitat (n=49)	48.46%	30.77%	No: p=.13*
Wetlands (n=116)	58.89%	15.38%	Yes: p<.001
Herbs			
All Cases (n=199)	51.16%	45.16%	No: p=.40
Type I Habitat (n=28)	45.04%	82.09%	No: p=.22
Type II & III Habitat (n=50)	44.29%	46.29%	No: p=.85
Wetlands (n=121)	53.49%	42.86%	No: p=.21

*marginally significant

Conclusions

- When a canopy layer is present it is generally dominated by native species.
- Success rates are significantly lower for habitat permits if trees and shrubs are not present at the mitigation site.

- Success rates for Type I habitat permits are significantly higher when tress or shrubs are present.
- Success rates are much lower if the tree or shrub layer is dominated ny non-natives.

Chapter 6.D.2 Related Analyses

Chapter 6.D.2-1 Success Rates when trees or shrubs are present

Questions:

1. What are the differences in success rates when trees, shrubs, or both are present?

Results:

Table 6.D-7. If both trees and shrubs are present on site, what is the success rate? (actual data distribution)

Strata	None present	Only trees present	Only shrubs present	Both present	Total
Type I Habitat	61	28	0	46	135
Type II & III Habitat	7	3	0	52	62
Wetlands	9	0	2	135	146
Total	77	31	2	233	343

Table 6.D-8. Population estimates for success rates depending on the absence or presence of trees and shrubs

Strata	None present	Only trees present	Only shrubs present	Both present	Significant differences?
All Cases	4.15%	77.88%	50.00% (n=2)	52.80%	Yes: p<.001
Type I Habitat	0% (n=7)	80.49% (n=3)	-	53.93%	Yes: p<.001
Type II & III Habitat	9.27%	38.92%	-	45.14%	Yes: p<.01
Wetlands	44.44% (n=9)	-	54.07% (n=2)	54.07%	No: p=.78

Conclusions:

- The presence of trees or trees and shrubs greatly increases the likelihood of success for Type I habitat permits.

Chapter 6.E Canopy Coverage

Questions:

1. What is the distribution of observed canopy coverage for trees, shrubs, and herbs?
2. Does the distribution vary by data strata?
3. Do success rates vary across the distribution of canopy coverage for various canopy layers?

Results:

Table 6.E-1 Actual sample data distribution(all strata)

Coverage Class*	Trees	Shrubs	Herbs
0-5%	85	58	26
5-25%	75	78	34
25-50%	33	42	19
50-75%	43	23	32
75-95%	8	8	67
95-100%	1	1	32
Total	245	210	210

*Daubenmeier Coverage Scale

Table 6.E-2 Population estimates for the distribution of tree canopy coverage

Coverage Class	Percent	95% confidence interval
all cases (n-245)		
0-5%	35.22%	29.81% - 41.03%
5-25%	30.76%	25.56% - 36.49%
25-50%	13.33%	9.97% - 17.60%
50-75%	16.69%	12.99% - 21.19%
75-95%	3.52%	1.95% - 6.29%
95-100%	0.48%	0%< - 2.46%
Type I Habitat (n=69)		
0-5%	52.88%	39.27% - 66.07%
5-25%	34.69%	22.92% - 48.68%
25-50%	5.29%	1.80% - 14.53%
50-75%	6.53%	2.63% - 15.31%
75-95%	0.62%	0%< - 3.86%
95-100%	0%	N/A
Type II & III Habitat (n=49)		
0-5%	38.45%	28.99% - 48.88%
5-25%	30.19%	21.41% - 40.72%
25-50%	11.10%	6.25% - 18.96%
50-75%	20.25%	13.22% - 29.75%
75-95%	0%	N/A
95-100%	0%	N/A
Wetland (n=127)		

0-5%	26.77%	20.76% - 33.78%
5-25%	29.13%	22.91% - 36.25%
25-50%	17.32%	12.43% - 23.62%
50-75%	20.47%	15.16% - 27.06%
75-95%	5.51%	2.97% - 10.01%
95-100%	0.79%	0.15% - 4.04%

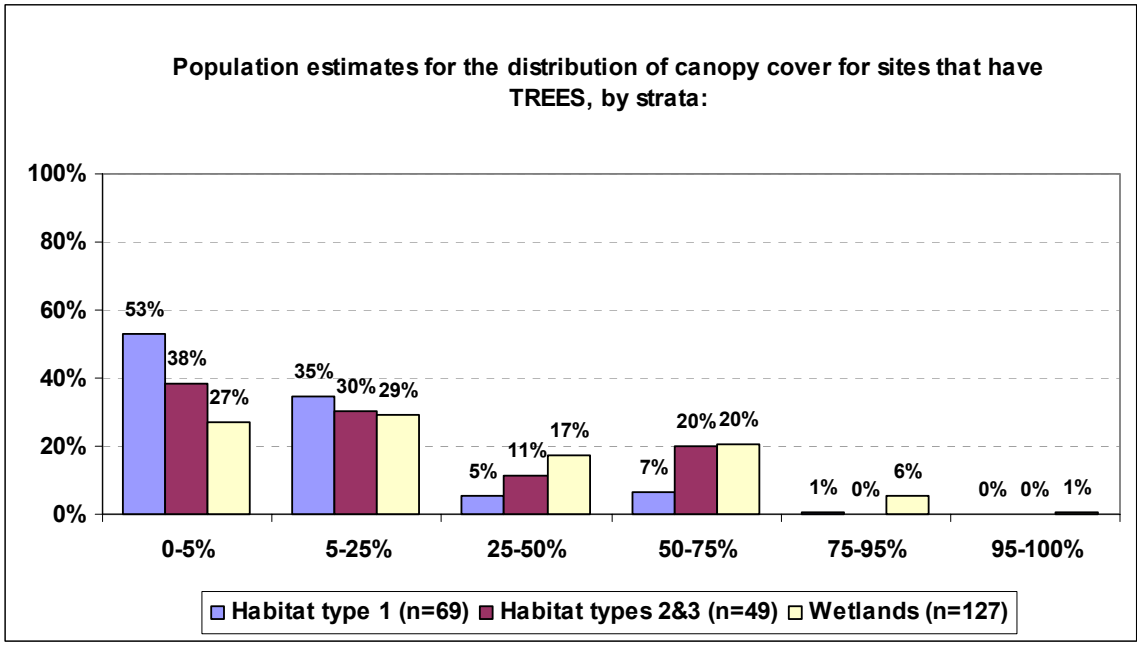

Table 6.E-1. Population estimates for the distribution of tree canopy coverage

Table 6.E-3 Population estimates for the distribution of Shrub canopy cover

Coverage Class	Percent	95% confidence interval
all cases (n-210)		
0-5%	27.13%	22.08% - 32.86%
5-25%	34.19%	28.77% - 40.06%
25-50%	21.49%	16.98% - 26.83%
50-75%	12.39%	8.81% - 17.14%
75-95%	4.22%	2.34% - 7.49%
95-100%	0.57%	0.11% - 2.90%
Type I Habitat (n=29)		
0-5%	37.13%	17.07% - 62.89%
5-25%	41.91%	21.51% - 65.52%
25-50%	9.90%	3.72% - 23.82%
50-75%	9.08%	1.24% - 44.29%
75-95%	1.98%	0.25% - 13.85%
95-100%	0%	N/A
Type II & III Habitat (n=49)		
0-5%	39.62%	30.06% - 50.04%

5-25%	45.53%	35.64% - 55.79%
25-50%	6.83%	3.00% - 14.80%
50-75%	8.02%	3.97% - 15.53%
75-95%	0%	N/A
95-100%	0%	N/A
Wetlands (n=132)		
0-5%	23.48%	17.96% - 30.09%
5-25%	31.06%	24.84% - 38.04%
25-50%	25.76%	20.00% - 32.50%
50-75%	13.64%	9.42% - 19.34%
75-95%	5.30%	2.87% - 9.60%
95-100%	0.76%	0.15% - 3.83%

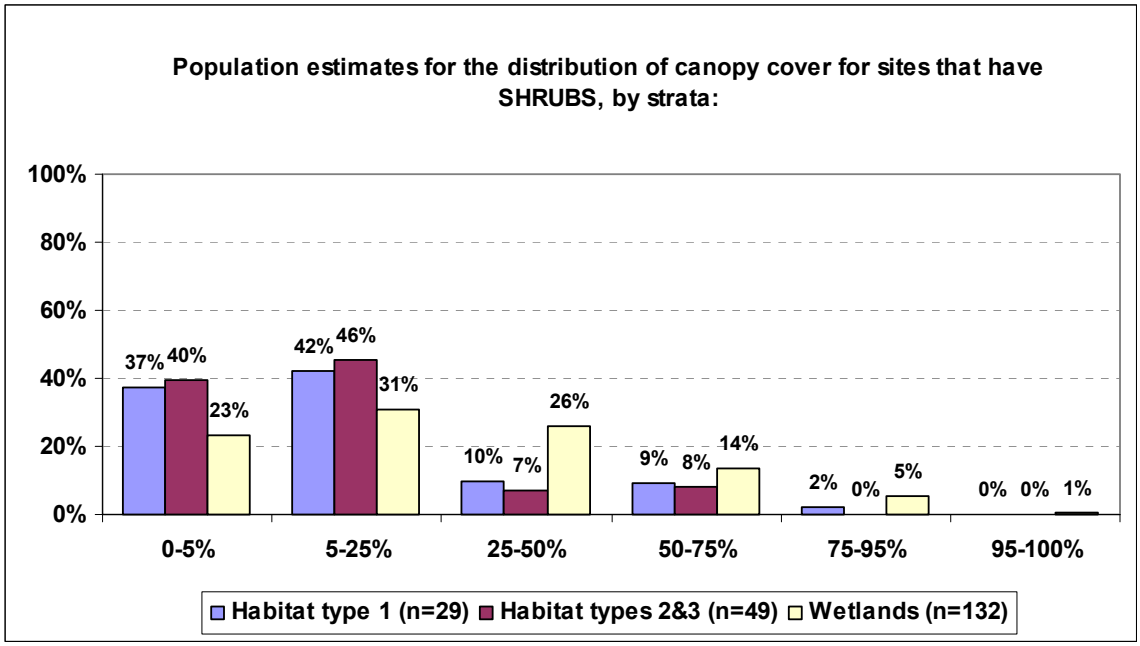

Table 6.E-2. Population estimates for the distribution of Shrub canopy cover

Table 6.E-4 Population estimates for the distribution of Herb canopy cover

Coverage Class	Percent	95% confidence interval
all cases (n-210)		
0-5%	11.39%	8.09% - 15.80%
5-25%	13.04%	9.60% - 17.47%
25-50%	6.56%	4.37% - 9.73%
50-75%	15.76%	11.91% - 20.56%
75-95%	35.69%	30.17% - 41.62%
95-100%	17.57%	13.45% - 22.61%
Type I Habitat (n=32)		
0-5%	19.20%	6.82% - 43.55%
5-25%	45.58%	24.71% - 68.13%

25-50%	14.02%	6.13% - 28.96%
50-75%	4.01%	0.93% - 15.61%
75-95%	17.20%	5.54% - 42.39%
95-100%	0%	N/A
Type II & III Habitat (n=43)		
0-5%	16.24%	9.36% - 26.68%
5-25%	31.79%	22.08% - 43.38%
25-50%	13.92%	7.64% - 24.03%
50-75%	17.18%	9.91% - 28.11%
75-95%	13.92%	7.64% - 24.03%
95-100%	6.96%	2.92% - 15.70%
Wetlands (n=135)		
0-5%	9.63%	6.20% - 14.66%
5-25%	5.93%	3.35% - 10.27%
25-50%	4.44%	2.29% - 8.44%
50-75%	17.04%	12.37% - 23.00%
75-95%	41.48%	34.75% - 48.55%
95-100%	21.48%	16.26% - 27.83%

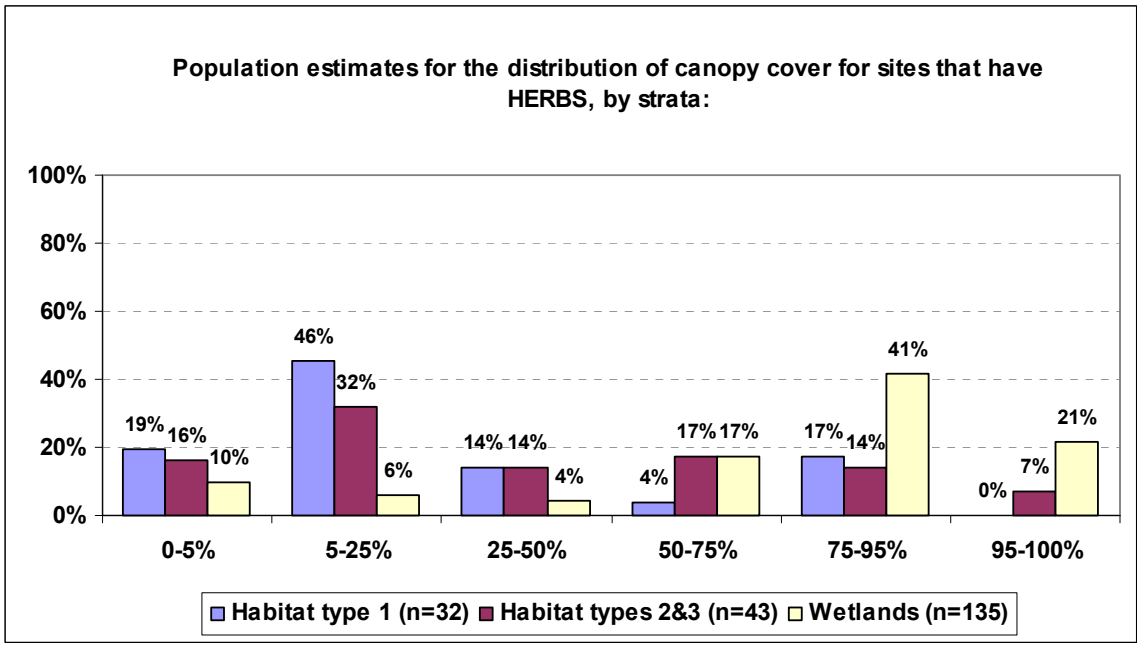

Table 6.E-3. Population estimates for the distribution of Herb canopy cover

Table 6.E-5 Population estimates for success rates of cases that have tree cover by Coverage Class.

Coverage class	Success rate	Significant differences?
all cases (n=245)		
0-5%	43.55%	Differences in success rates between coverage classes are statistically
5-25%	65.82%	

25-50%	71.25%	significant (p<.01).
50-75%	68.55%	
75-95%	86.39%	
95-100%	100%	
Type I Habitat (n=69)		
0-5%	65.79%	Differences in success rates between coverage classes are statistically significant (p<.05).
5-25%	84.74%	
25-50%	100%	
50-75%	18.90%	
75-95%	100%	
95-100%	N/A	
Type II & III Habitat (n=49)		
0-5%	35.43%	Differences in success rates between coverage classes are only marginally significant (p=.18).
5-25%	48.43%	
25-50%	64.93%	
50-75%	61.56%	
75-95%	N/A	
95-100%	N/A	
Wetland (n=127)		
0-5%	26.47%	Differences in success rates between coverage classes are statistically significant (p<.001).
5-25%	59.46%	
25-50%	68.18%	
50-75%	76.92%	
75-95%	85.71%	
95-100%	100%	

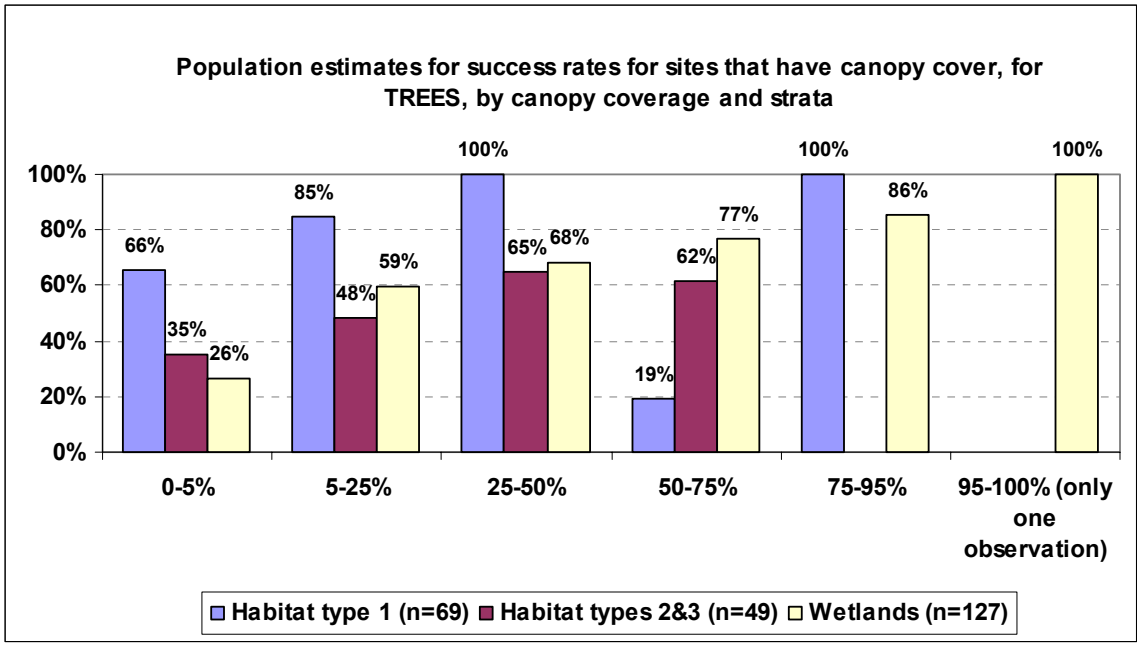

Figure 6.E-4. Population estimates for success rates of cases that have tree cover by Coverage Class.

Table 6.E-6 Population estimates for success rates for cases that have shrub cover by Coverage Class

Coverage Class	Success rate	Significant differences?
all cases (n=210)		
0-5%	30.37%	Differences in success rates between coverage classes are statistically significant (p<.001).
5-25%	51.49%	
25-50%	77.69%	
50-75%	71.80%	
75-95%	59.16%	
95-100%	0% (n=1)	
Type I Habitat (n=29)		
0-5%	54.22%	Differences in success rates between coverage classes are not statistically significant (p=.45).
5-25%	59.45%	
25-50%	80.00%	
50-75%	0% (n=1)	
75-95%	100% (n=1)	
95-100%	N/A	
Type II & III Habitat (n=49)		
0-5%	39.26%	Differences in success rates between coverage classes are statistically significant (p<.01).
5-25%	38.33%	
25-50%	100.00%	
50-75%	75.00%	
75-95%	N/A	
95-100%	N/A	
Wetland (n=132)		
0-5%	22.58%	Differences in success rates between coverage classes are statistically significant (p<.001).
5-25%	53.66%	
25-50%	76.47%	
50-75%	77.78%	
75-95%	57.14%	
95-100%	0% (n=1)	

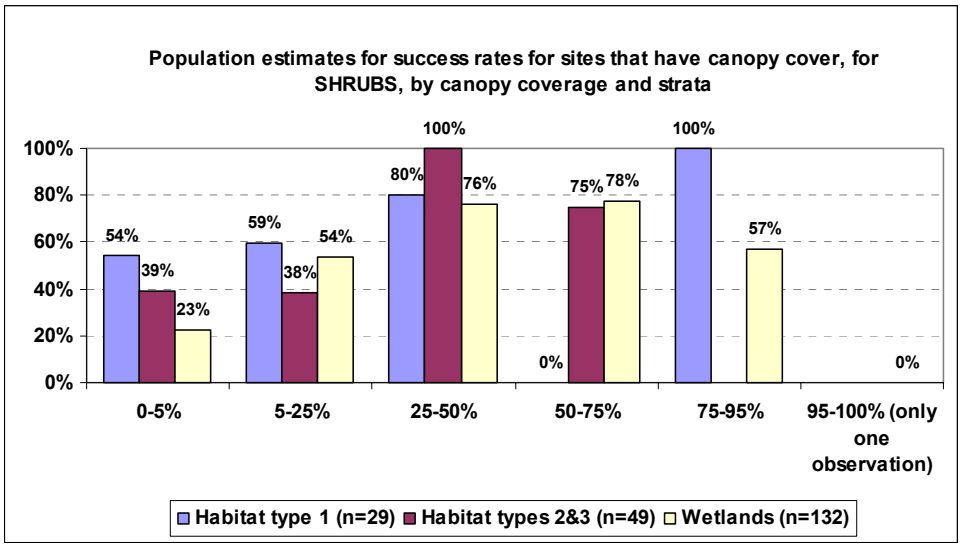

Figure 6.E-5. Population estimates for success rates for cases that have shrub cover by Coverage Class

Table 6.E-7 Population estimates for success rates for cases that have herb cover by Coverage Class

Coverage Class	Success rate	Significant differences?
all cases (n=210)		
0-5%	43.09%	Differences in success rates between coverage classes are not statistically significant (p=.21).
5-25%	54.66%	
25-50%	32.18%	
50-75%	51.29%	
75-95%	60.73%	
95-100%	55.73%	
Type I Habitat (n=32)		
0-5%	31.30%	Differences in success rates between coverage classes are not statistically significant (p=.23).
5-25%	57.88%	
25-50%	28.57%	
50-75%	50.00%	
75-95%	88.35%	
95-100%	N/A	
Type II & III Habitat (n=43)		
0-5%	42.86%	Differences in success rates between coverage classes are not statistically significant (p=.61).
5-25%	41.62%	
25-50%	66.67%	
50-75%	45.99%	
75-95%	33.33%	
95-100%	66.67%	
wetland (n=135)		
0-5%	46.15%	Differences in success rates between coverage classes are not statistically
5-25%	62.50%	

25-50%	16.67%	significant (p=.21).
50-75%	52.17%	
75-95%	60.71%	
95-100%	46.15%	

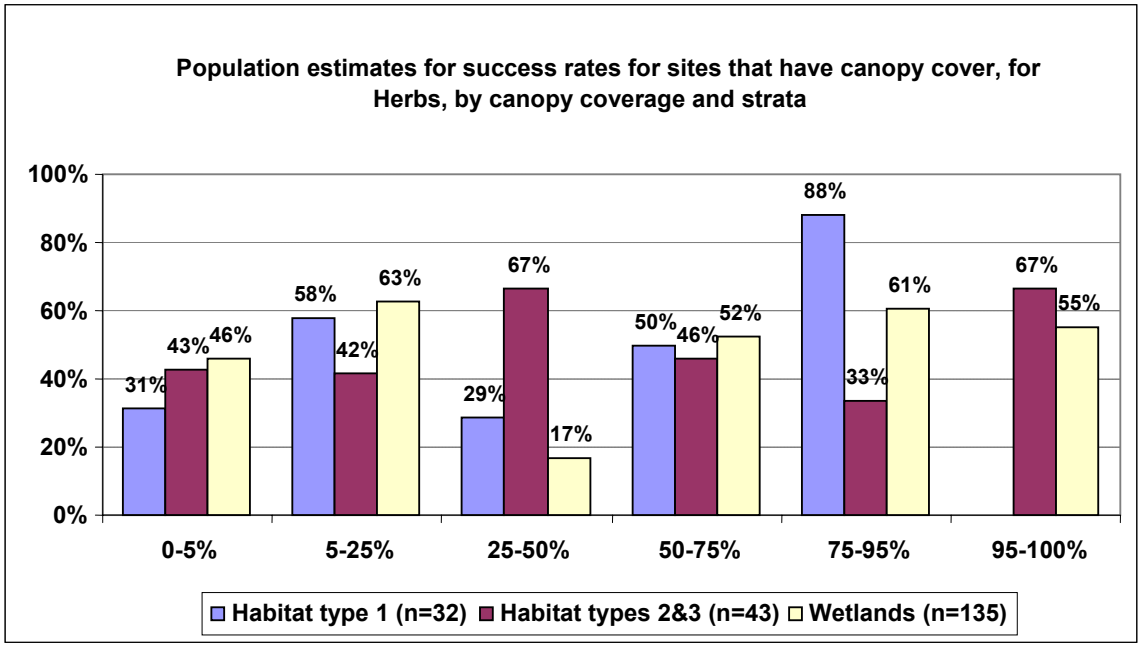

Figure 6.E-6. Population estimates for success rates for cases that have herb cover by Coverage Class

Conclusions:

- Tree and shrub canopy cover is generally less than 25% for most cases.
- Less than 20% of the cases were close to the 75% canopy coverage standard that is typical for wetland mitigation plans.
- Success rates tend to increase with increased canopy coverage of trees and shrubs.

Chapter 6.E.2 Related Analyses

Chapter 6.E.2-1 Success Rates by Coverage Class across the distribution of functional ratings for the Plantings Element

Questions:

1. How do success rates vary across the distribution of canopy coverage of trees and shrubs for various functional ratings of the plantings element (plant maintenance)?

Results:

Table 6.E-8. Success rates* as a function of Plantings functional rating (horizontal) and canopy cover of trees (vertical) when the plat maintenance was required and completed.

Coverage Class	Functional Rating for Plantings Element				
	1	**2**	**3**	**4**	**5**
0-5%	0% (6)	7% (14)	18% (11)	88% (16)	93% (14)
5-25%	0% (2)	0% (8)	38% (8)	88% (16)	89% (19)
25-50%	0% (1)	33% (3)	67% (6)	100% (11)	100% (4)
50-75%	-	0% (4)	80% (5)	65% (20)	100% (9)
75-95%	-	-	100% (1)	100% (1)	100% (3)
95-100%	-	-	-	-	-

*Actual n in parenthesis.

Table 6.E-9. Success rates* as a function of Plantings functional rating (horizontal) and canopy cover of shrubs (vertical) when plant maintenance was required and completed.

Coverage Class	Functional Rating for Plantings Element				
	1	**2**	**3**	**4**	**5**
0-5%	0% (3)	11% (9)	0% (8)	73% (11)	100% (5)
5-25%	0% (1)	8% (12)	63% (16)	65% (17)	80% (15)
25-50%	-	0% (3)	100% (2)	82% (17)	100% (11)
50-75%	-	0% (1)	100% (2)	89% (9)	100% (3)
75-95%	-	-	100% (1)	100% (1)	100% (2)
95-100%	0% (1)	-	-	-	-

*Actual n in parenthesis.

Conclusions:

- Success rates are poor and canopy coverage is lower when plant maintenance is done poorly.

Chapter 6.F Invasive Species Dominance in Canopy Layers

Questions:

1. How frequently do invasive species dominate varios canopy layers?
2. How does the dominance of invasive species in various canopy layers affect mitigation success?

Results:

Table 6.F-1. For sites where each canopy layer was present, did the invasive species dominate? (actual data distribution)

Strata	Invasive species dominates	Invasive species does not dominate
Trees		
Type I Habitat	5	48
Type II & III Habitat	6	39
Wetlands	2	123
Total	13	210
Shrubs		
Type I Habitat	1	20
Type II & III Habitat	10	32
Wetlands	33	99
Total	44	151
Herbs		
Type I Habitat	19	14
Type II & III Habitat	28	23
Wetlands	68	66
Total	115	103

Table 6.F-2 Population estimates for the percent of canopy layers present on the site that are dominated by invasive species

Strata	Estimate	Significant differences?
Trees		
All Cases (n=223)	4.85%	Differences between strata in percent dominated by invasive species are statistically significant (p<.01).
Type I Habitat (n=53)	8.75%	
Type II & III Habitat (n=45)	14.17%	
Wetlands (n=125)	1.60%	
Shrubs		
All Cases (n=195)	22.95%	Differences between strata in percent dominated by invasive species are statistically significant (p<.01).
Type I Habitat (n=21)	2.57%	
Type II & III Habitat (n=42)	23.17%	
Wetlands (n=132)	25.00%	
Herbs		
All Cases (n=218)	51.89%	Differences between strata in percent dominated by invasive species are not
Type I Habitat (n=33)	58.43%	

Type II & III Habitat (n=51) Wetlands (n=134)	53.41% 50.75%	statistically significant (p=.67).

Table 6.F-3 Population estimates for mitigation success rates depending on whether the canopy layers are dominated by invasive species or NOT dominated by invasive species

Strata	Invasive species dominates	Invasive species does not dominate	Significant differences?
Trees			
All Cases (n=223)	0%	63.36%	Yes: p<.001
Type I Habitat (n=53)	0%	83.64%	Yes: p<.001
Type II & III Habitat (n=45)	0%	53.57%	Yes: p<.01
Wetlands (n=125)	0%	57.72%	Yes: p=.05
Shrubs			
All Cases (n=195)	23.52%	63.44%	Yes: p<.001
Type I Habitat (n=21)	0%	65.27%	No: p=.25*
Type II & III Habitat (n=42)	0%	60.80%	Yes: p<.001
Wetlands (n=132)	27.27%	63.64%	Yes: p<.001
Herbs			
All Cases (n=218)	45.93%	63.03%	Yes: p<.01
Type I Habitat (n=33)	57.70%	71.66%	No: p=.46*
Type II & III Habitat (n=51)	31.41%	62.75%	Yes: p<.01
Wetlands (n=134)	47.06%	62.12%	Yes: p<.05

*small n

Conclusions:

- Dominance of the tree and shrub layers is not common.
- The herb layer is dominated buy invasives in about half the cases.
- No habitat cases dominated by invasives in the tree and shrub layers succeeded
- If invasive species do not dominate, success rates increase, especially for Type II and III habitat permits.

Chapter 6.G Canopy Design

Questions:

1. How frequently is a multi-layered canopy proposed in mitigation plans?
2. Does the proposal of a multilayered canopy affect success rates?

Results:

Table 6.G-1. Was mitigation formulated to create a multi-layered canopy? (actual sample data)

Status	Type I Habitat	Type II & III Habitat	Wetland	Total
Yes	20	50	95	165
No	114	12	48	174
Total	134	62	143	339

Table 6.G-2. Population estimates for the percent of sites where mitigation was formulated to create a multi-layered canopy

Strata*	Estimate	95% confidence interval
All Cases (n=339)	40.59%	36.85% - 44.33%
Type I Habitat (n=134)	7.90%	4.16% - 11.65%
Type II & III Habitat (n=62)	76.84%	69.67% - 84.01%
Wetlands (n=143)	66.43%	60.06% - 72.80%

*Differences are statistically significant (p<.001).

Table 6.G-3. Population estimates for mitigation success rates for sites where mitigation was formulated to create multi-layered canopy versus NOT multi-layered canopy

Strata	Multi-layered canopy	No multi-layered canopy	Significant differences?
All Cases (n=339)	50.23%	31.67%	Yes: p<.001
Type I Habitat (n=134)	66.26%	23.23%	Yes: p<.001
Type II & III Habitat (n=62)	41.74%	30.14%	No: p=.23
Wetlands (n=143)	50.53%	56.25%	No: p=.43

Conclusion:

- A Multi-layered canopy is common for Type II and III permits and rare for Type I Habitat permits.
- Designing mitigation as a multi-layered canopy improves the likelihood of success for Type I habitat permits.

Chapter 6.G.2 Related Analyses

Chapter 6.G.2-1 Distribution of the canopy cover for trees and shrubs when formulated as a multi-layered canopy layer

Question:

1. Does the distribution of canopy coverage in the tree and shrub layers change when the mitigation is designed as a multi layered canopy?

Results:

Table 6.G-4 If site mitigation was formulated as a Multi-Layered Canopy, what is the distribution of the canopy cover for trees and shrubs? (actual data sample distribution)

Coverage Class	Type I Habitat	Type II & III Habitat	Wetlands	Total
Trees				
0-5%	3	16	22	41
5-25%	9	12	27	48
25-50%	3	4	16	23
50-75%	4	10	17	31
75-95%	-	-	3	3
95-100%	-	-	1	1
Total	19	42	86	147
Shrubs				
0-5%	5	18	20	43
5-25%	8	19	29	56
25-50%	4	3	23	30
50-75%	-	4	13	17
75-95%	-	-	3	3
95-100%	-	-	1	1
Total	17	44	89	150

Table 6.G-5 Population estimates for the distribution of canopy cover for trees and shrubs when mitigation is formulated as a layered canopy

Coverage Class	All Cases	Type I Habitat	Type II & III Habitat	Wetlands
Trees (n=147)				
0-5%	29.19%	41.25%	37.33%	25.58%
5-25%	30.68%	27.00%	29.76%	31.40%
25-50%	16.94%	19.75%	8.64%	18.60%
50-75%	19.81%	12.00%	24.27%	19.77%
75-95%	2.53%	0%	0%	3.49%
95-100%	0.84%	0%	0%	1.16%
Total	100%	100%	100%	100%
Shrubs (n=150)				

0-5%	28.45%	50.27%	41.81%	22.47%
5-25%	34.64%	36.97%	41.69%	32.58%
25-50%	21.37%	12.76%	7.59%	25.84%
50-75%	12.28%	0%	8.92%	14.61%
75-95%	2.46%	0%	0%	3.37%
95-100%	0.82%	0%	0%	1.12%
Total	100%	100%	100%	100%

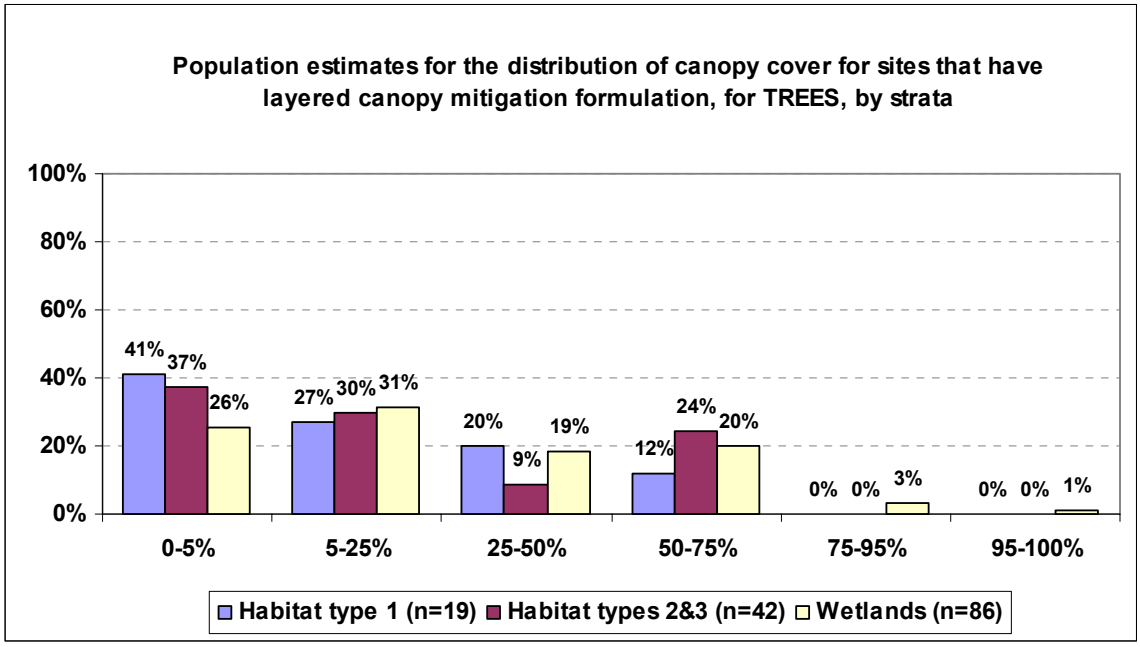

Figure 6.G-1. Population estimates for the distribution of canopy cover for sites that have layered canopy mitigation formulation, for Trees, by Strata

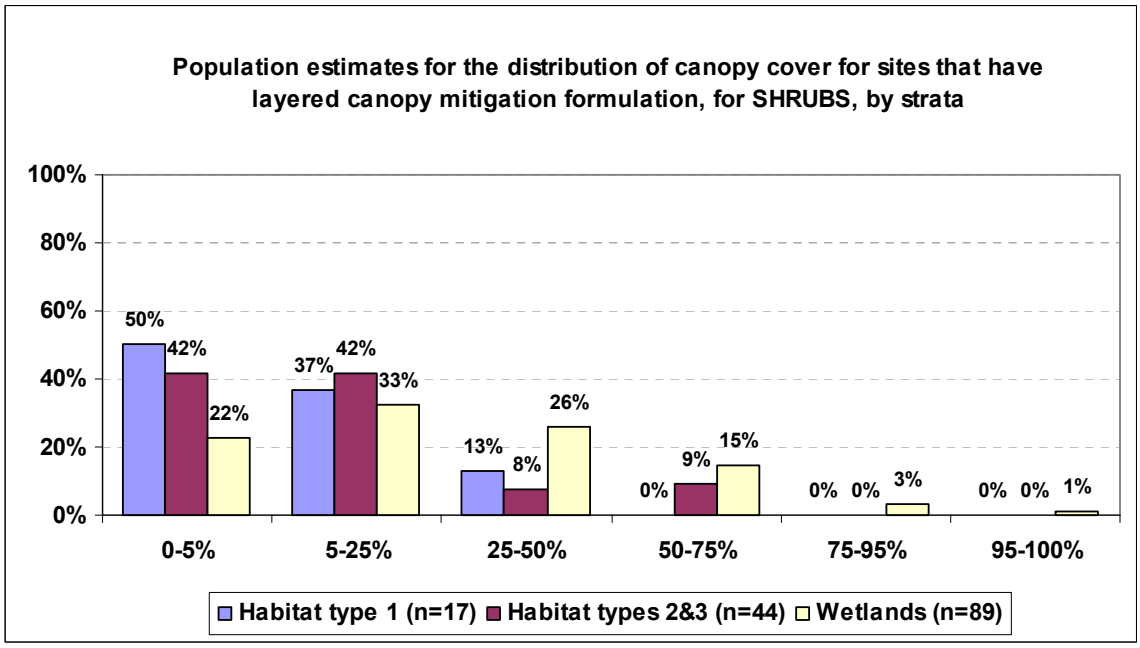

Figure 6.G-2. Population estimates for the distribution of canopy cover for sites that have layered canopy mitigation formulation, for Shrubs, by Strata

Conclusion:

- Designing mitigation as a multi-layered canopy generally does not alter observed canopy coverage
- Tree coverage is shifted slightly higher for Type I habitat permits when a multi-layered canopy is proposed.

Chapter 6.H Disturbance

Questions:

1. How common are visible disturbances to mitigation sites?
2. How do various disturbances relate to mitigation success?

Results:

Table 6.H-1. Are there visible causes for disturbance? (actual sample data)

Status	Type I Habitat	Type II & III Habitat	Wetland	Total
Human				
Yes	7	27	86	120
No	128	35	60	223
Total	135	62	146	343
Animal				
Yes	7	17	21	45
No	128	45	125	298
Total	135	62	146	343
Disease				
Yes	0	1	4	5
No	135	61	142	338
Total	135	62	146	343

Table 6.H-2. Population estimates for the percent of sites with visible disturbances

Strata	Estimate	Significant differences?
Human		
All Cases (n=343)	31.44%	Differences between strata in percent sites with disturbances are statistically significant (p<.001).
Type I Habitat (n=135)	3.23%	
Type II & III Habitat (n=62)	39.61%	
Wetlands (n=146)	58.90%	
Animal		
All Cases (n=343)	9.65%	Differences between strata in percent sites with disturbances are statistically significant (p<.001).
Type I Habitat (n=135)	1.59%	
Type II & III Habitat (n=62)	25.54%	
Wetlands (n=146)	14.38%	
Disease		
All Cases (n=343)	1.36%	Differences between strata in percent sites with disturbances are statistically significant (p=.01).
Type I Habitat (n=135)	0%	
Type II & III Habitat (n=62)	1.47%	
Wetlands (n=146)	2.74%	

Table 6.H-3. Population estimates for success rates for sites with disturbances versus sites with no disturbance

Strata	Disturbance	No disturbance	Significant differences?
Human			
All Cases(n=343)	40.85%	38.98%	No: p=.69
Type I Habitat (n=135)	53.53%*	25.45%	No: p=.13**
Type II & III Habitat (n=62)	29.63%	45.24%	Yes: p<.05
Wetlands (n=146)	41.86%	70.00%	Yes: p<.001
Animal			
All Cases (n=343)	54.27%	37.99%	Yes: p<.05
Type I Habitat (n=135)	71.43%*	25.62%	Yes: p=.001
Type II & III Habitat (n=62)	54.04%	33.92%	Yes: p<.05
Wetlands (n=146)	52.38%	53.60%	No: p=.90
Disease			
n is very small (only five sites with disease presence, and their success rate is 22.26%, as opposed to an All Cases success rate of 39.80% for all other sites).			

*small n (n=7)
**marginally significant

Conclusion:

- Human disturbances are common in wetland cases, less common in Type II and III habitat cases and rare in Type I habitat cases.
- Human disturbances moderately reduce the likelihood that mitigation will succeed.

Chapter 6.G.2 Related Analyses

Chapter 6.G.2-1 Access Management and Disturbance

Question:

1. For cases where Access Management, Physical Demarcation, or Signage was required, does the success rate differ with the presence or absence of human disturbances?

Results:

Table 6.H-4. Success rates when Access Management, Physical Demarcation or Signage is required and completed versus the presence of Human Disturbance. (p<.001)

	Success rate when human disturbance is present	Success rate when human disturbance is not present
Access Management, Physical Demarcation or Signage is required and completed	46.03%	77.70%

I don't think this is the question we intended to ask?

Conclusion:

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Chapter 6.I Mitigation Performance

Chapter 6.I.1-1 Meeting Plan Goals and Functional Performance

Questions:

1. How often are sites functional and reflect the goals of the mitigation plan?
2. How do success rates differ when sites are functional and meet the goals of the mitigation plan vs. not?

Results:

Table 6.I-1. Is the site functional and does it reflect the goal of the mitigation plan? (actual sample data)

Status	Habitat I	Type II & III Habitat	Wetland	Total
Yes	45	24	73	142
No	90	38	73	201
Total	135	62	146	343

Table 6.I-2. Population estimates for the percent of sites where the site is functional and reflects the goal of the mitigation plan

Strata	Estimate	Significant differences?
All Cases (n=343)	38.01%	Differences between strata in percent sites that are functional and reflect the goal of the mitigation plan are statistically significant (p<.001).
Type I Habitat (n=135)	26.58%	
Type II & III Habitat (n=62)	37.59%	
Wetlands (n=146)	50.00%	

Table 6.I-3. Population estimates for success rates for sites where the site is functional and reflects the goal of the mitigation plan, versus site that are not functional and didn't meet the goal of the mitigation plan

Strata	Functional/ goal met	Not functional/goal not met	Significant differences?
All Cases (n=343)	94.96%	5.60%	Yes: p<.001
Type I Habitat (n=135)	96.57%	0.93%	Yes: p<.001
Type II & III Habitat (n=62)	84.39%	11.75%	Yes: p<.001
Wetlands (n=146)	95.89%	10.96%	Yes: p<.001

Conclusion:

- The goals of most mitigation plans are generally identifying appropriate ecological functions to enhance or create.

Chapter 6.I.1-2 Compliance with Permit Conditions

Question:

1. How frequently does mitigation meet the performance standards prescribed in the conditions, permit or mitigation plan report?
2. How does meeting performance standards affect success?

Results:

Table 6.I-4 Does it meet the performance standards prescribed in the conditions, permit or mitigation plan report? (actual sample data)

Status	Habitat I	Type II & III Habitat	Wetland	Total
Yes	43	27	42	112
No	92	35	102	229
Total	135	62	144	341

Table 6.I-5. Population estimates for the percent of sites where standards are met

Strata	Estimate	Significant differences?
All Cases (n=341)	28.32%	Differences between strata in percent sites that meet the standards are statistically significant (p<.05).
Type I Habitat (n=135)	24.49%	
Type II & III Habitat (n=62)	41.99%	
Wetlands (n=144)	29.17%	

Table 6.I-6. Population estimates for success rates for sites where standards are met versus those that did NOT meet the standards

Strata	Performance Standards Met	Performance Standards not met	Significant differences?
All Cases (n=341)	88.97%	19.54%	Yes: p<.001
Type I Habitat (n=135)	88.30%	6.26%	Yes: p<.001
Type II & III Habitat (n=62)	72.05%	15.17%	Yes: p<.001
Wetlands (n=144)	95.24%	35.29%	Yes: p<.001

Conclusions:

- 30% of all wetland permit cases complied with performance standards and conditions, yet 50% of the cases were successful. This suggests that the standards used do not relate well to success of mitigation, but the designs intended to achieve those standards can succeed anyway.
- For habitat permits, standards are met about as often as sites are successful, but there are a significant number of unsuccessful cases were standards have been met. This suggests that the standards used do not necessarily ensure success.